# Towards an Analysis of Turinese Italian Intonation and Theoretical Implications for Intonational Phonology.

by

Sveva Besana

B.A. Linguistics and Psychology
University of Massachusetts at Amherst, 1996

Submitted to the Department of Linguistics and Philosophy
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Linguistics

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Signature of Author.....
Department of Linguistics and Philosophy
June 28, 1999

Certified by.....
Michael Kenstowicz
Professor of Linguistics
Thesis Supervisor

Accepted by.....
Michael Kenstowicz
Professor of Linguistics
Chairman, Committee for Graduate Students

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ABSTRACT

Digitized data of a northern variety of Standard Italian declarative statements', yes/no questions' and wh-questions' was collected to describe a partial grammar of intonational morphemes in the language and provide an analysis for the utterances. Two major theories of intonational phonology are outlined and tested against the data. It is shown how Pierrehumbert's autosegmental theory best captures the data presented here with respect to intonation patterns at the boundaries. Evidence for the existence of a L, and a LH tone is put forward. In particular, it is proposed that, on the one hand, when LH tones map onto prominent syllables of *foci* they are followed by a L- phrase tone in declaratives and a H- phrase tone in yes/no interrogatives; on the other hand when the LH tones map onto prominent syllables of *topics* they are always followed by a H- phrase tone. Finally, the unstable mapping of the LH tone onto the F0 contour found here is considered against current notions of alignment.

Thesis Supervisor: Michael Kenstowicz
Title: Professor of Linguistics

## 1. Introduction

The goal of this thesis is twofold: to describe the intonational structure of a variety of Standard Italian which is spoken in a northwestern region of the country, Piemonte[1], and to give a theoretically relevant contribution based on the collected corpus. Before Pierrehumbert's Ph.D. dissertation on English Intonation (1980) and her subsequent work (Beckman and Pierrehumbert 1986; Pierrehumbert and Beckman 1988), studies devoted to Italian intonation have been sparse and have concentrated mainly on distinguishing between declarative type contours and yes/no question type contours[2]. These studies have made use of different descriptive frameworks implemented on different varieties of Italian. In some of these approaches tunes are categorized according to the shape of the whole pattern, therefore taken as indivisible entities, or they are categorized only according to the shape of the final part of the contour. In others, tunes are subdivided in different "phonemic levels", which include but do not exhaust a low, mid and high level. Within these frameworks the "basic patterns" range from two to three (declarative, yes/no question and sometimes suspensive or non-final clauses).

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[1] The recorded speech on which the analyses are based is my own. I have lived in the Piemonte region for most of my life and although I do not speak the regional dialect, Piemontese, the variety of Standard Italian I speak undoubtedly shares with it some, if not most, intonational features.

[2] For an overview of these studies see Grice (1995) and references cited therein.

These earlier frameworks are reminiscent of either the British-style approach or the levels-approach of the American school (see Ladd 1996 and Grice 1995 for an overview of both of these approaches to intonation). Even one of the most comprehensive studies based on Palermo Italian (a southern variety of Italian), due to Grice (1995), greatly influenced by Pierrehumbert's theory, has focused mainly on yes/no type interrogation.

This study is justified in that it will examine a variety of Italian which has not been previously studied. In addition, it will do so adopting elements from Pierrehumbert's model as a starting point. Such a model has been successful in describing not only the intonational structure of English but also that of Japanese (which, unlike English and Italian, has lexically specified tone). However, given that Pierrehumbert's autosegmental approach to intonation is not the only approach which has been proposed since Goldsmith's (1976) work on autosegmental phonology, other models will have to be considered as alternatives, at least for the variety of Standard Italian being studied here (henceforth $SI_T$[3]).

The main alternative approach which will be considered is the one proposed by Ladd (1983, 1996), which differs from Pierrehumbert's in few but important respects. We will see that not all aspects of Pierrehumbert's framework will translate successfully. For example, a two-level distinction (Low (L) and High (H)) will be adopted; however, not

[3] $SI_T$ the subscripted "T" stands for Torino which is the province I have lived in. A mere characterization of the variety of Italian which takes into consideration just the region (Piemonte) misses the fact that within regions different provinces may have different intonational contrasts.

all of the pitch accents that appear in the inventory for English turn out to be included in the inventory of shapes that constitute the pitch accents of $SI_T$.

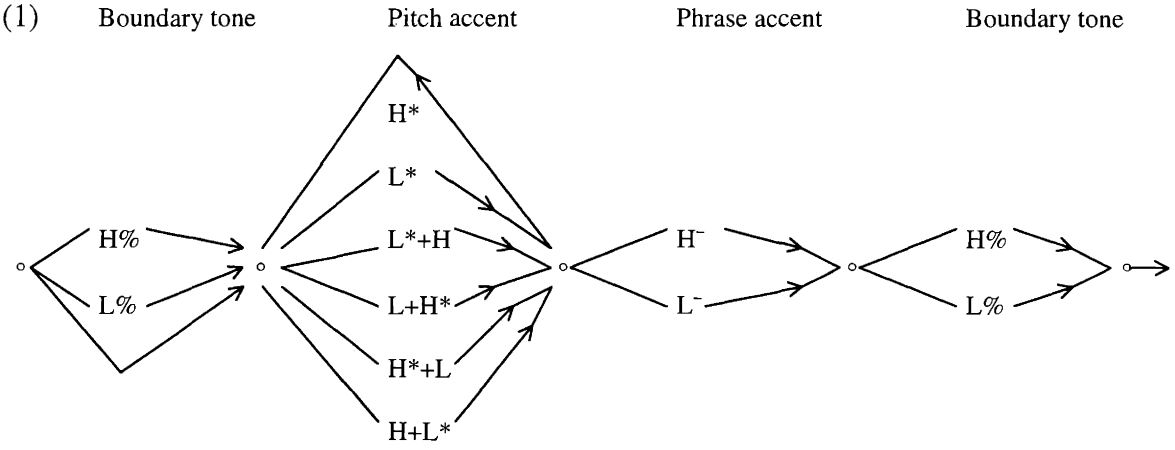
In analyzing the intonational contours, I will give evidence for which and how particular tones or tonal sequences are mapped onto narrow (contrastive) focus, broad focus, other non-final constituents and events at the boundaries. The analysis I will propose will base itself on recordings and fundamental frequency tracks. In the description of the corpus I will concentrate on the tonal tier, i.e. the part which corresponds more closely to the phonological analysis of the utterance's intonation pattern. I will leave out information about breaks in the utterances (break indices, for readers familiar with ToBI transcription; see Silverman et al. (1992) and Pitrelli et al. (1994)) since most of that information can be deducted from the presence, or absence, of phrase tones in the tonal tier.

## 2. Pierrehumbert's model (1980) and subsequent versions

The three main objectives of Pierrehumbert's 1980 study were (i) to describe the different intonational patterns that a given text can have in order to delineate a grammar of allowable tunes for English, (ii) to investigate the implementation of the same pattern on texts with different stress patterns and (iii) to propose rules which assign a phonetic value to the phonological representation (tone) and construct the F0 contour between one tone and the next. An outcome of (i) is that the grammar delineated will be able to generate certain tunes as sequences of H(igh) and L(ow) tones; in addition, the primitives of the

grammar, that is, the inventory of tones, are what is stored in an "intonational lexicon", not the allowable tunes (as has been suggested by, for example, Liberman 1975). Regarding (ii) certain assumptions will have to be made about which "kind of things" tones are allowed to associate with, in addition to metrically strong syllables (a departure from the association with vowels found in Goldsmith 1976); crucial, here, will be the concept of boundary or edge tones. As regards (iii) the rules will be either phonological or phonetic in nature. The grammar that generates the possible tunes of English has been delineated as in (1):

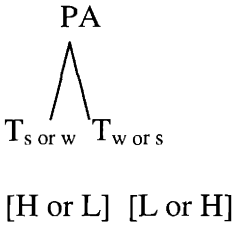
(1)



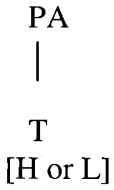

Pitch accents are tonal patterns that may be assigned to metrically strong, or stressed, syllables. The pitch accent inventory for English (as described by Pierrehumbert and colleagues) initially included two monotonal and four bitonal pitch accents as follows: H*, L*, H*+L, H+L*, L*+H, L+H*. The L and H tones occur at the lowest and highest part of the speaker's pitch range, this means that the L will be phonetically realized as a

local F0 minimum and the H as a local F0 maximum. The asterisk indicates which of the two tones is associated with the metrically strong syllable. The starred tone's F0 valley or peak is usually realized within the segment that constitutes the metrically strong syllable (the associated syllable). In Pierrehumbert 1980 pitch accents did not have any internal configuration. But in a subsequent investigation of Japanese tone structure Pierrehumbert and Beckman (1988) propose that each tone be part of a tonal tree with the structure in (2) or (3) depending on the nature of the tone (monotonal or bitonal):

(2)




(3)




The tree in (2) will thus generate the bitonal pitch accents, H*+L, H+L*, L*+H and L+H* while the one in (3) the monotonal pitch accents, H* and L*.

Pitch accents are associated to metrically strong syllables (more precisely, to strong feet where there is a percolation to syllables); there may be pitch accents preceding the one on the nuclear syllable (the syllable which bears the nuclear stress of the phrase)

but no pitch accents following it. An important point is that, for Pierrehumbert, nuclear pitch accents are the rightmost pitch accents. These pitch accents correlate with the most prominent metrical syllable in the sentence. So, for example, the accented syllable of a constituent which bears contrastive focus, in virtue of being the most prominent in the sentence, will be the one associated with the rightmost pitch accent, that is, the nuclear one.

There are two levels of phrasing involved in the specification of tunes: the intermediate phrase and the intonational phrase. The intonational phrase contains one or more intermediate phrases. Usually intermediate and intonational phrases are identified by pauses and the syllable lengthening that occurs phrase finally.

Boundary tones (T%) are aligned with either the right or left edge of the intonational phrase. Boundary tones do therefore not align with a syllable like pitch accents do but they characterize the F0 contour at the end of the utterance. In this model, boundary tones and phrase accents (the other kind of edge tone, which will be introduced below) are edge tones for prosodic constituents. Thus any flat string that is being used to characterize intonational contours (for example, H* L L%) is merely a shorthand version of a representation that would incorporate associations between prosodic structure and tonal structure. Phrase accents (T- or T), like boundary tones, do not align with syllables either, usually they align with the right edge of the intermediate phrase. More will be said regarding the intermediate phrase, for now it is important to define it as a smaller constituent than the intonational phrase, usually preceded by a very brief pause.

Since an intonational phrase can be made up of one or more intermediate phrases it can have one or more phrase accents. A phrase accent has to be posited in order to explain the F0 contour right after the last pitch accent but before the intonational phrase boundary and therefore the boundary tone. The following are examples of legitimate constituencies and respective tone sequences:

(4) an intonational phrase with one phrase accent

$[\,[\ldots H^*\ \ L-\,]_{ip}\ L\%]_{IP}$

last pitch accent

(5) an intonational phrase with two phrase accents

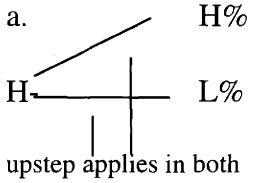
$[\,[\ldots H^*\ \ L-\,]_{ip}\,[\ldots H^*\ \ L-\,]_{ip}\,]_{IP}$

Pierrehumbert 1980 gives evidence for the fact that alignment of the phrase accent with the text is sensitive to the nuclear word's (the word that carries the pitch accent) edge. Regardless of the stress pattern of the nuclear word the phrase accent has been found to align with the right edge of the word, exceptions being cases of long words (words with four or more syllables). What distinguishes the phrase accent from the trailing tone of one of the bitonal pitch accents is the fact that in the latter cases the unstarred trailing tone occurs 20-25 cs after the starred tone while in the former cases the phrase accent is more delayed.

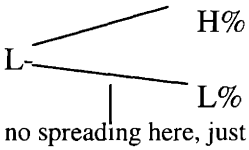
In cases where the nuclear word is the last word in the intonational phrase the separate influence of the phrase accent and the boundary tone will be difficult to discern, but whenever there are a number of syllables intervening between the phrase accent and the boundary tone the separate effects will become apparent. This scenario obtains whenever the word carrying the nuclear pitch accent is early on in the sentence, as in cases of early/initial contrastive focus.

Phrase accents, together with the trailing tones of pitch accents, are the only tones that can undergo spreading. The phrase accent spreads whenever the next tone is phonetically equal or higher. This means that there are four possible configurations after a phrase accent, these are shown in (6):

(6) a.

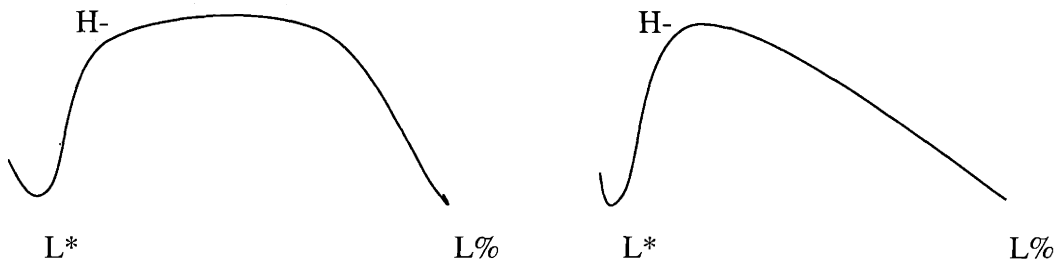



b.




In (6a.) we have a H phrase accent followed by either a H% or a L%. The reason why the L% is phonetically equal and the H% is higher has to do with a posited local rule, *upstep*. Upstep is what rises the phonetic value of a tone in a particular context. In this case H% and L% target values are shifted upwards after the H phrase accent. Such a rule would preclude the existence of contours as in (7), and in fact English lacks such contours.

(7)




In (6b.) no upstep rule applies. In addition there is no spreading before the L%. This is because the L% is on the baseline (the bottom of the speaker's range) and so from L to L% we only see a very gradual fall.

For English, the four different combinations of phrase and boundary tones have been associated with four types of utterances (see Pierrehumbert and Hirschberg, 1990). The L phrase accent followed by a L boundary tone has been associated with declarative utterances as in (8):

(8) Anna bought the newspaper.
H* H* L- L%

The sentence above can also be realized with a H% boundary tone as in (9) leading to what has been called a 'continuation rise' contour:

(9) Anna bought the newspaper.
H* H* L- H%

With the continuation rise contour the speaker wants to convey that the utterance is to be interpreted with respect to the following one(s); in this case (9) may felicitously be followed by 'She thought it would contain the article by that famous journalist', an utterance which explains why the newspaper was bought. The H- H% sequence is typical of yes-no question contours,

(10) Did she know about the detour?
H- H%

while the H- L% sequence (also called 'final plateau'), mapped to (11b), is used on material that supports the previous utterance:

(11) a. She talked about the plan.
b. In detail.
H* H- L%

**3. Ladd's variant (1983, 1990, 1996)**

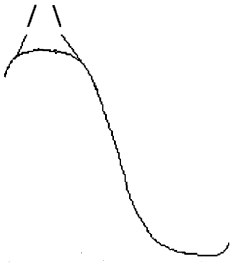
Ladd's inventory of pitch accents is as follows: H, L, HL, and LH. One main difference between this class of tones and Pierrehumbert's is that here we only have two bitonal tones. This is a consequence of the fact that Ladd takes the nuclear tone as describing the F0 contour within and right after the nuclear syllable. Thus, he does not need the asterisk to indicate alignment since in bitonal tones the left tone will always be the one that aligns

with the nuclear syllable. In Pierrehumbert's model the nuclear pitch accent may include specification of pitch levels in tones occurring immediately before the nuclear syllable. This is the case for H+L*, for example, where we have alignment of the L tone with the nuclear syllable and a H target before that (either outside or within the nuclear syllable window).

A problem arises in that Ladd still has to explain the F0 movement preceding the pitch accent in some way or other. His solution for a preceding high contour, which Pierrehumbert would analyze as a leading H, is to conceive of the sequence high contour + low contour (H+L* for Pierrehumbert) as a H followed by a downstepped H. Here the second H would have a [+downstep] feature associated with it and the F0 plateau between the previous H and before the beginning of the downstep would have a [+sustained pitch] feature associated with it. So, for a preceding high contour relative to a following F0 contour which is associated with a stressed syllable we have the following two analyses:

(12) Pierrehumbert: H+L*

Ladd: H [+sustained pitch] ( feature of the F0 contour following the H not a feature of the H itself)



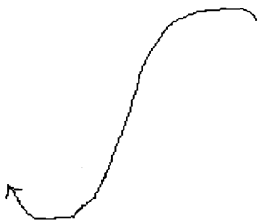
H [+downstep]

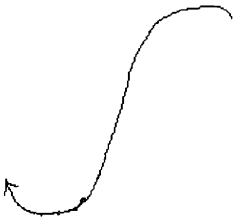
To account for a preceding low contour Ladd posits either a HL sequence or a H pitch accent before the nuclear syllable; in the former case the low contour would be explained by the L of the HL sequence while in the latter case it would be explained by [-sustained pitch] between the H and the nuclear pitch accent, which will result in a dip between the the two tones. For a preceding low contour we have the following analyses:

(13) Pierrehumbert: L+H*

Ladd: HL……H or H…[-sustained pitch]…H

H H





(H) L (H) [-sustained pitch]

As far as edge tones are concerned, only boundary tones are part of Ladd's model; he contends that there are no phrase accents in English. What Pierrehumbert would call a phrase accent in a particular F0 contour Ladd considers a trailing tone of a bitonal accent. We will see that it is not always easy to tell if a trailing tone of a pitch accent or an edge tone is responsible for the F0 movement following the nuclear syllable.

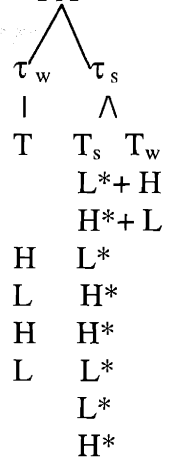
Another major difference is the introduction of features (of tones or of F0 contours) in Ladd's system, which account, among other things, for misalignment of a

tone with the nuclear syllable, for the realization of F0 contours in between tones (see the [± sustained pitch] feature above) and for certain "downstepping" contours.

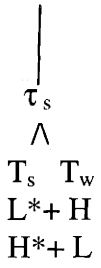
## 4. Grice (1995) and alignment

In her examination of interrogation intonation in Palermo Italian Grice makes an important contribution in that she notices a difference in the alignment properties of starred tones in English and Palermo Italian. In English, starred tones appear to always align with the same part of the nuclear syllable regardless of whether they are monotonal or part of a bitonal pitch accent, and, if the latter, regardless of their structure, T*+T or T+T*. By contrast, in Palermo Italian the starred tone seems to be less rigidly aligned. More specifically, for example, the L* in a HL* sequence is aligned with the earlier part of the syllable, while the L* in a L*H is aligned with the later part of the syllable. The alignment is therefore predictable, according to Grice. In addition, she finds that in order to adequately describe the contours she investigates there is a need to draw a distinction between different kinds of leading tones. Leading tones in English are posited to be less significant than they are in Palermo Italian; this difference, along with the one outlined above, is captured in the different pitch accent structures postulated for the two languages. According to Grice, English pitch accents will have structure as in (14) while Palermo Italian pitch accents will have the one in (15a.) and (15b.):

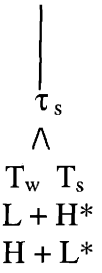
(14) PA




(15) a. PA




b. PA




An additional level of structure is introduced, the supertone (τ). The strong supertone node dominates the main part of the pitch accent which mandatorily has a head, the strong T, and optionally has a weak T. In English the strong supertone is always on the right branch and if it branches it is always left-headed. This structure guarantees fixed alignment for the starred tone (towards the later part of the syllable). Additionally, Grice stipulates that not all three tonal slots can be filled for one pitch accent[4]. Her PA tree for English can account for all of the contours found in Pierrehumbert 1980. In Palermo

[4] As Grice points out this stipulation can actually follow from licensing properties of the strong T whereby it may only license adjacent slots from right to left or left to right.

Italian, the supertone can be either left- or right-headed. This optionality is what gives us different alignment properties for the bitonal pitch accents: in a X*Y sequence the X tone is aligned later in the syllable than the X in a YX* sequence. Another difference accounted for is the status of the leading tone in the two languages. In English the leading tone is always dominated by a weak $\tau$ while in Palermo Italian the leading tone is always dominated by a strong $\tau$; this fact translates into greater peripherality of the English leading tone. Finally, we also have an explanation for the absence of H*+H, H+H*, L*+L and L+L* in both languages, since these bitonal pitch accents would violate the Obligatory Contour Principle. Note that L-L* and H-H* , which do surface in English, do not violate the OCP because they are not dominated by sister nodes.

## 5. Data and tone sequence analysis

A description of $SI_T$ intonational contours is a precursor to the identification of the pitch accents used in the language and to an analysis of the structure of such pitch accents. To that end over 100 utterances were recorded and digitized using Kay Elemetrics Corp. Computerized Speech Lab hardware and software. Three repetitions for each utterance were recorded. Spectrograms were used in conjunction with the waveforms for segmentation of the speech input. The figures in this thesis will illustrate the F0 contour, for the relevant set, which has been deemed most 'readable' and representative of the phenomenon being explored.

The utterances recorded were of different types: declaratives and yes/no questions with broad focus[5], declaratives and yes/no questions with initial, medial and final narrow focus and wh-questions. Additional manipulations, within the types of utterances listed above, included presence/absence of overt subjects, since Italian, a pro-drop language, allows both types of syntactic structures. After a careful analysis of the different contours produced the pitch accents and the possible edge tones will be discussed in isolation.

*5.1 Declaratives*

The declarative sentences that have been analyzed include S(ubject)-V(erb)-O(bject) type declaratives with or without narrow focus at initial, medial and final position in the sentence, on the assumption that the word carrying narrow focus is the nuclear word of the utterance. Sentences with a VS order were also included to check for possible differences, if any, with the canonical order sentence types. Within this set transitive (*chiamare*) and unaccusative (*arrivare*) verbs were included to see whether the relative intonational patterns would show differences, perhaps due to different phrasing in the two cases. No differences were found. This finding shows that intonational structure is only sensitive to certain kinds of syntactic information, more specifically, it does *not* take into account thematic information. That prosody is not sensitive to thematic information has

[5] Yes/no questions with broad focus turn out to have the same pitch accent sequence as yes/no questions with final narrow focus. Such ambiguity does not surface in declaratives. In declaratives two different pitch accents are used to signal broad focus and narrow focus.

also been supported by Nespor and Vogel (1986) and more recently by Frascarelli (1997). I will not discuss this matter further and use the unaccusative verb *arrivare* (*to arrive*), or the transitive verb *dire* (*to say*) in the VS sentences, with the understanding that the analysis will generalize to both type of verbs.

*5.1.1 Neutral declaratives (broad focus)*

In Italian, sentence stress falls on the last word of the utterance. So we would expect to find an F0 movement of some relevance on the nuclear syllable of the last word of the intonational phrase. Pitch extraction was performed for a number of sentences which differ in the length of the last word and/or the placement of the nuclear stress within the word, the length of the utterance, presence/absence of overt subject. The following are some of the sentences produced to obtain the relevant contour (accented syllables relevant for the analysis are shown in bold):

(16) **Ma**rio mangia una **me**la
Mario eats an apple

(17) Gio**van**ni compra un gior**na**le
Giovanni buys a newspaper

(18) **Ane**mone compra un **mo**bile
Anemone will-buy a table

(19) **Ane**mone l'ho chiamata ieri sera
Anemone her-I have called yesterday night

(20) Anto**ne**lla compra il Corriere dal giornalaio dell'**an**golo
Antonella buys the Corriere from the newspaper stand at the corner

(21) Mari**lu'** nominera' il colpevole
Marilu' will-nominate the perpetrator

(22) Ha detto "**la**mina-me-lo"
He said laminate it for me (lit.: laminate-for me-it)

(23) Arriva Ma**ri**a
Arrives Maria
Maria is arriving

(24) Arriva Gio**va**nni
Arrives Giovanni
Giovanni is arriving

(25) Arriva Do**me**nico
Arrives Domenico
Domenico is arriving

(26) Ma**ri**a ed A**ne**mone arrivano a **Mon**za
Maria and Anemone arrive-3rd p.p. in Monza
Maria and Anemone arrive in Monza

(27) Sono arrivate a **Mon**za
Arrived-3rd p.p.fem. in Monza
They arrived in Monza

(28) **La**minamelo e' una parola plurisil**la**bica
"Laminamelo" is a word multisyllabic
"Laminamelo" is a multisyllabic word

(29) Lamine**ran**no
will-laminate-3rd p.p.
They will laminate

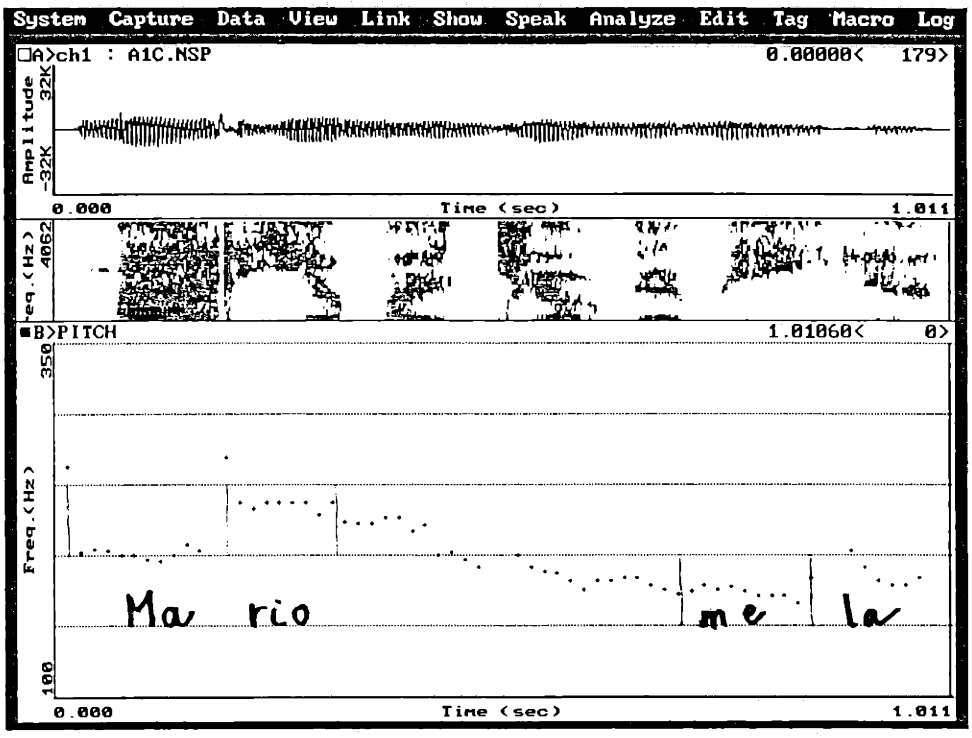



Figure for example (16)

**Ma**rio mangia una **me**la
LH H- L*L-L%

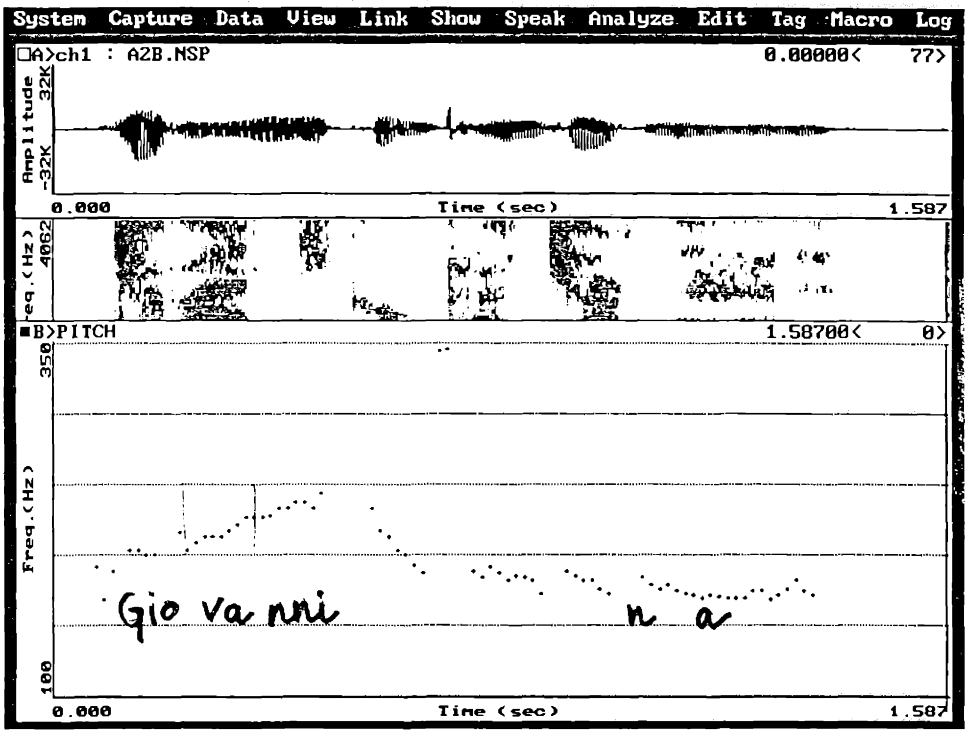



Figure for example (17) Giovanni compra un giornale
LH H- L*L-L%

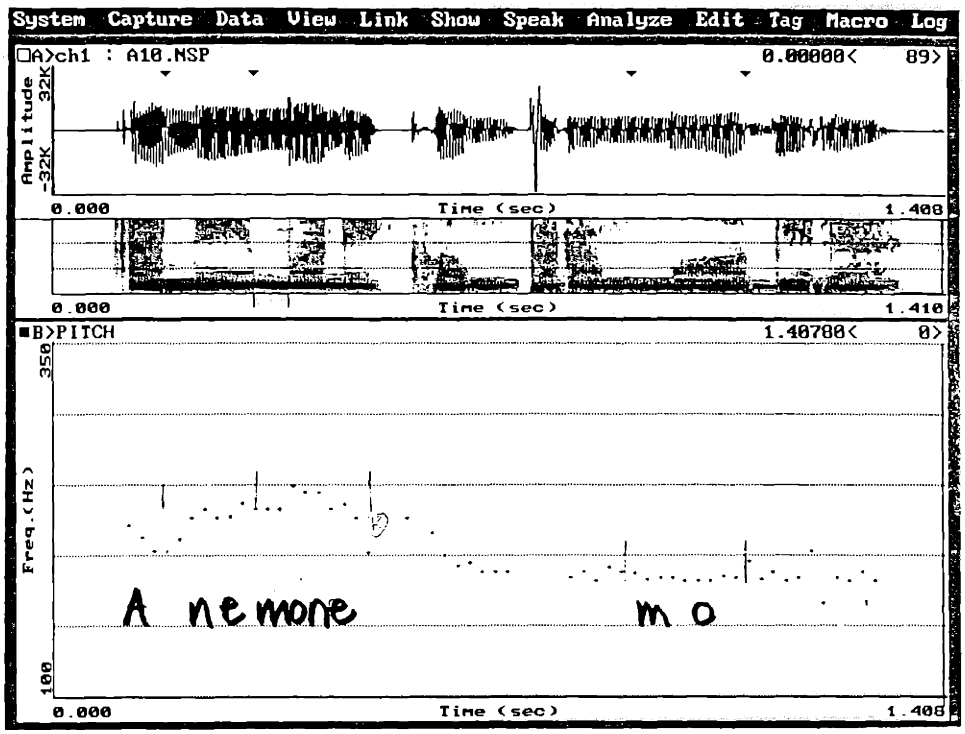



Figure for example (18) A**ne**mone compra un **mo**bile
LH H- L*L-L%

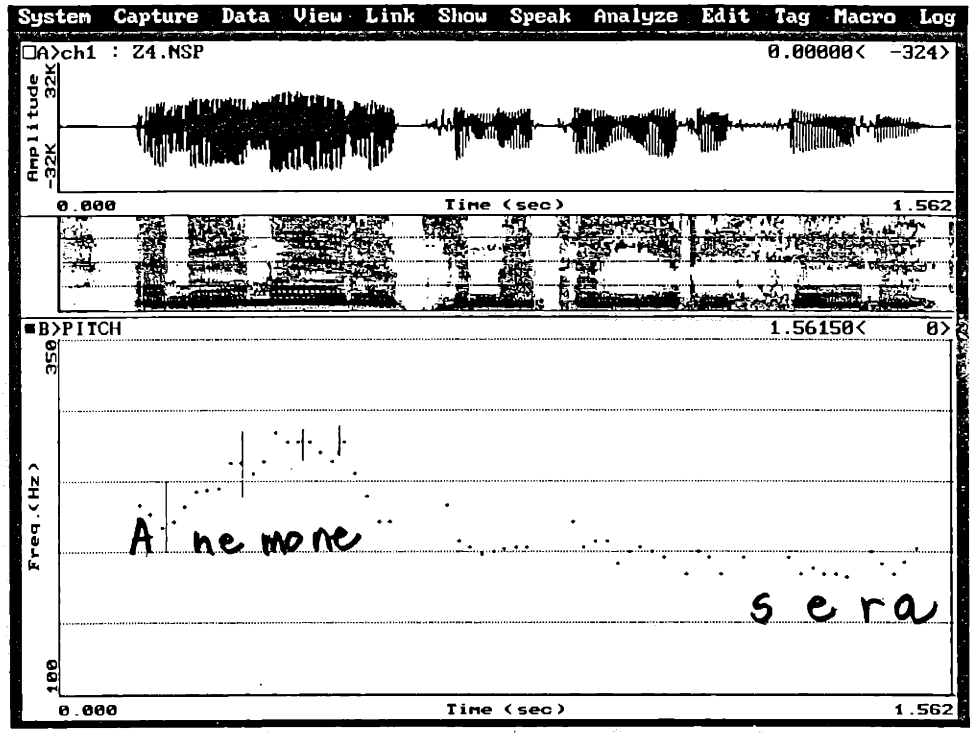



Figure for example (19) **An**emone l'ho chiamata ieri sera
LH H- L*L-L%

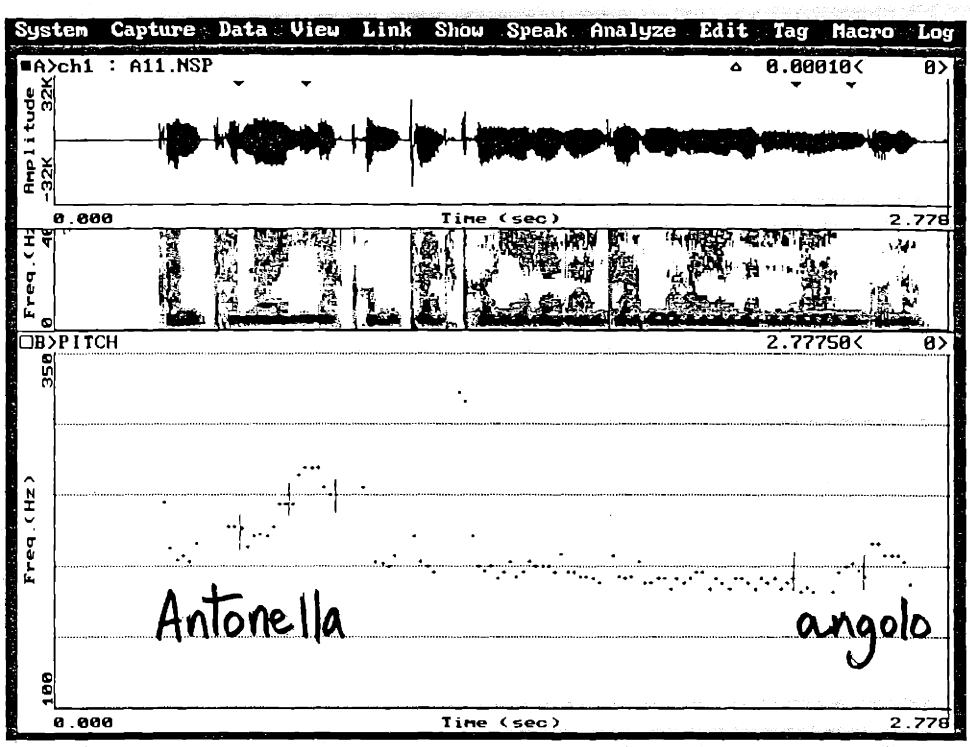



Figure for example (20)

Antonella compra il Corriere dal giornalaio dell' **an**golo
LH H- L* L-L%

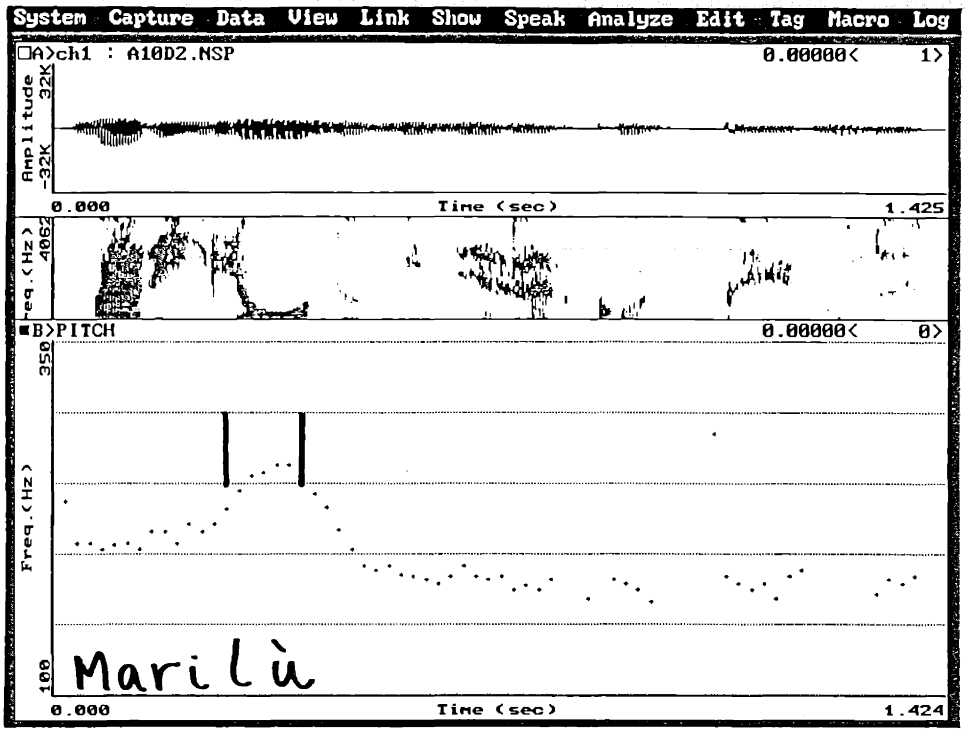



Figure for example (21) Mari**lu'** nominera' il col**pe**vole
LH H- L*L-L%

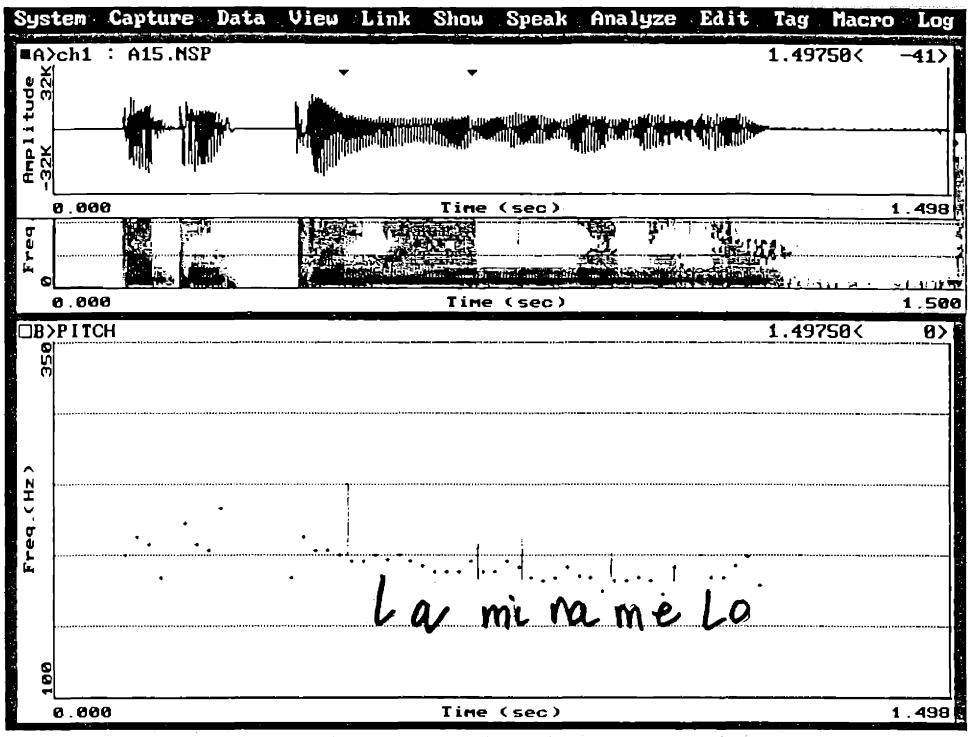



Figure for example (22)

Ha detto **la**minamelo
L* L-L%

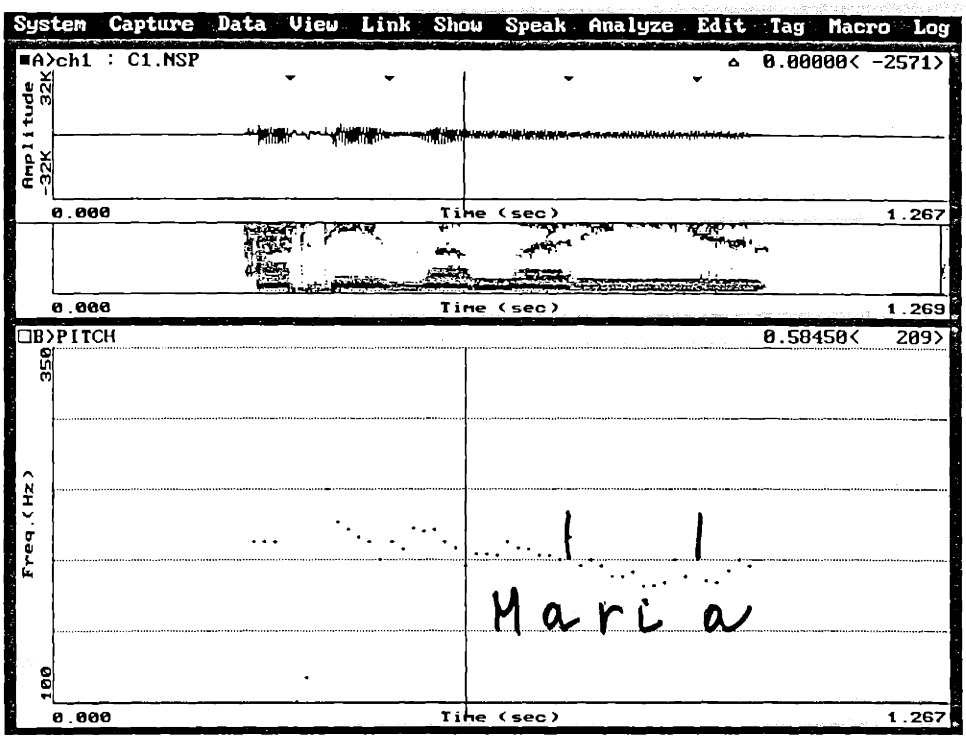



Figure for example (23) Arriva Maria

(H%) L*L-L%

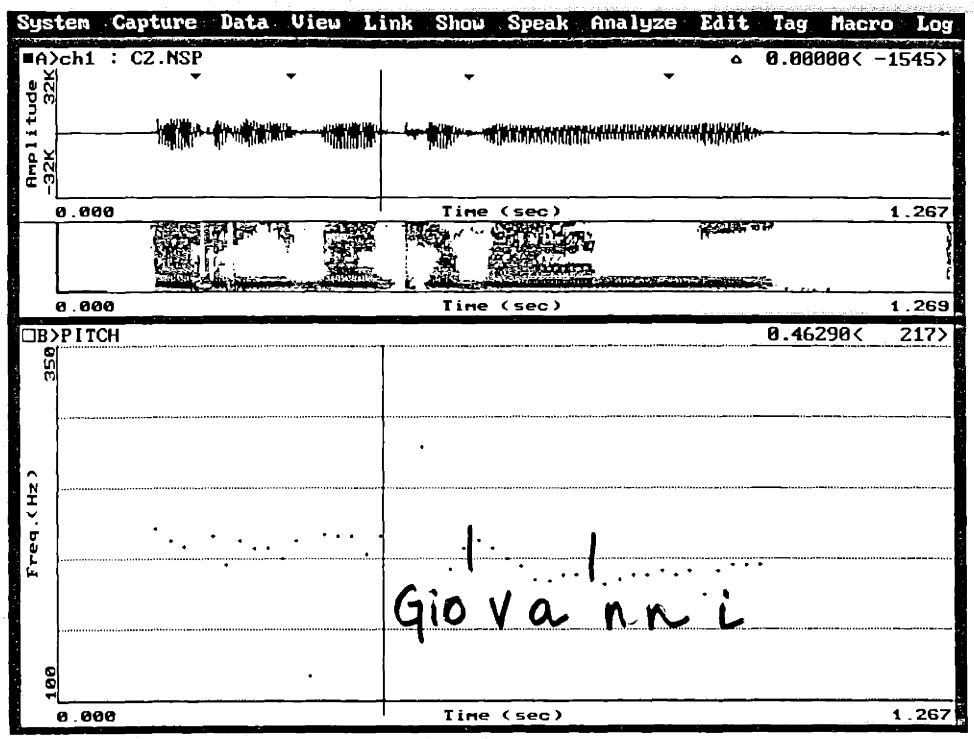



Figure for example (24) Arriva Giovanni
(H%) L*L-L%

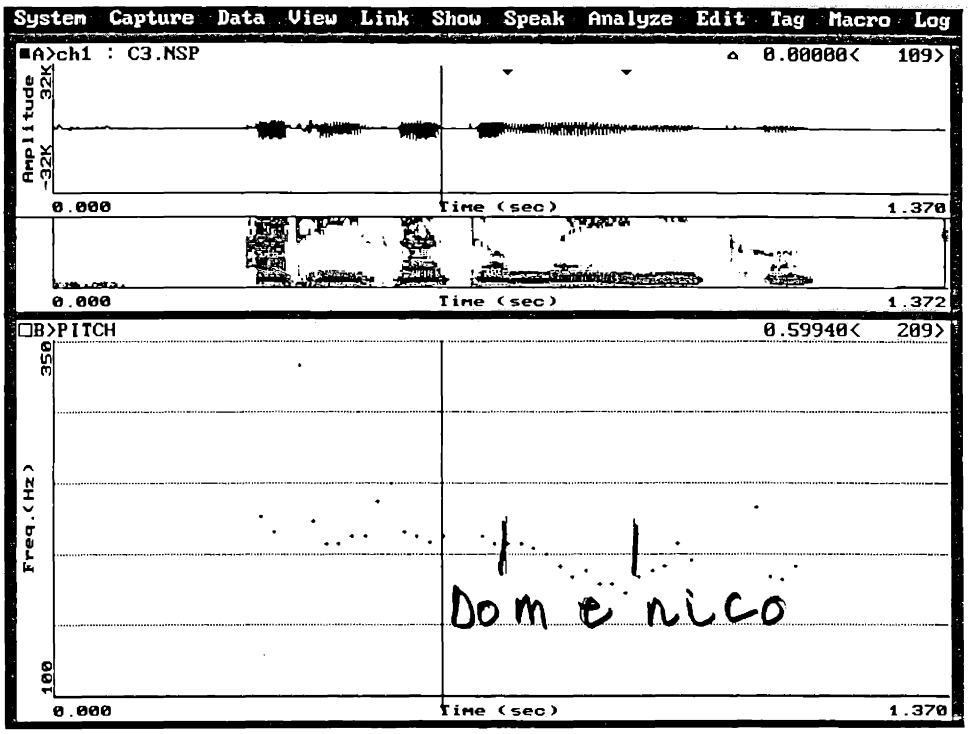



Figure for example (25) Arriva Domenico
(H%) L*L-L%

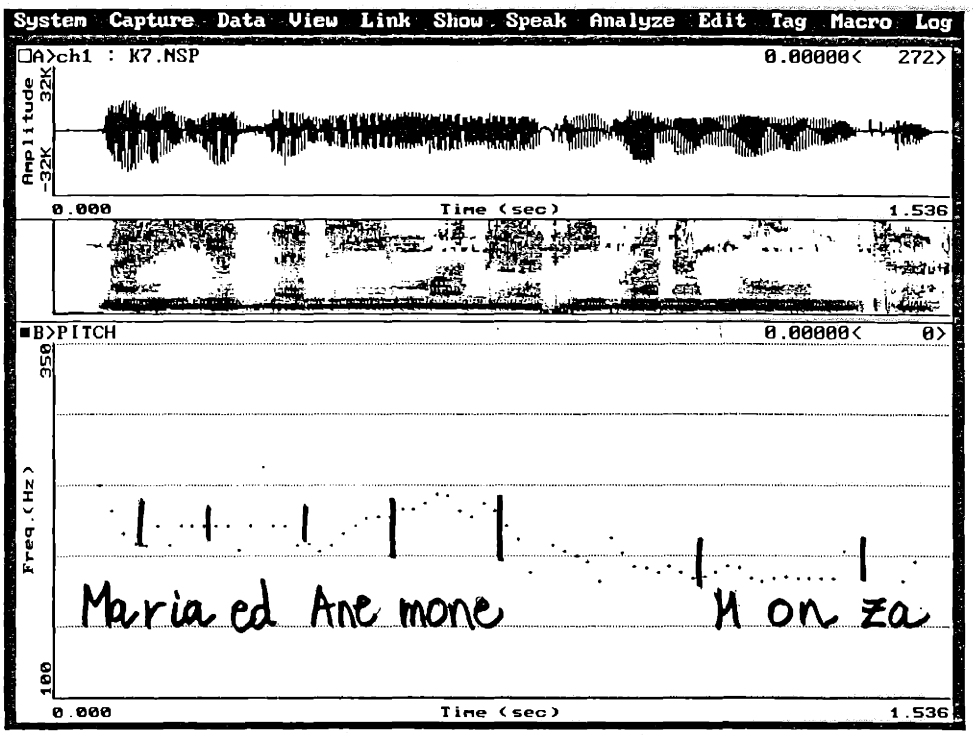



Figure for example (26) Maria ed Anemone arrivano a Monza
LH H- LH H- L*L-L%

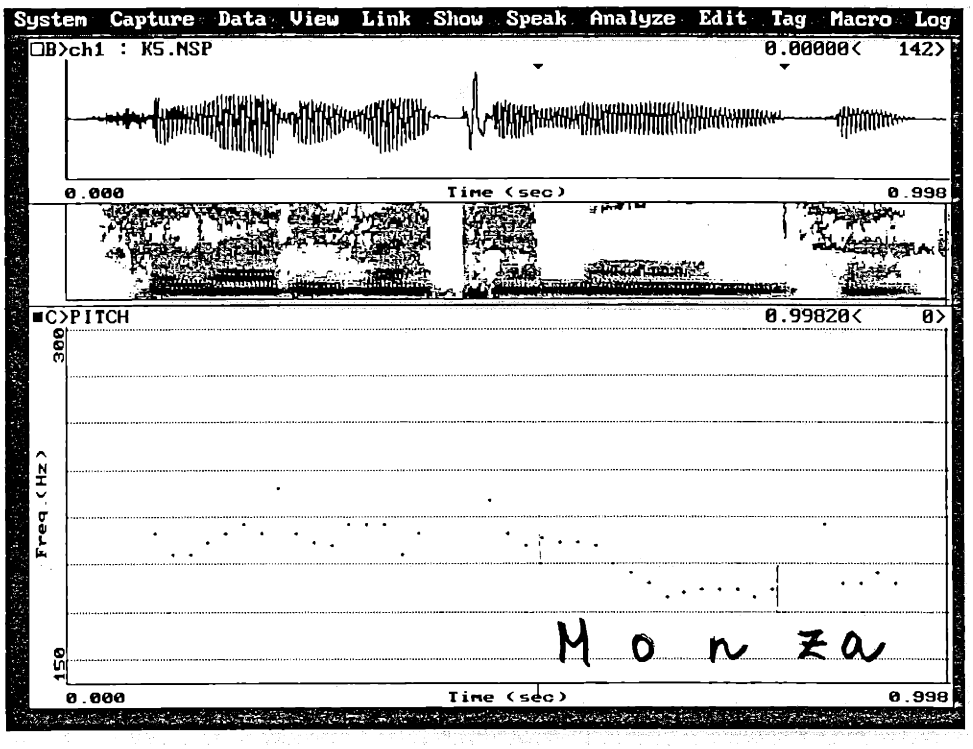



Figure for example (27)

Sono arrivate a **Monza**
L*L-L%

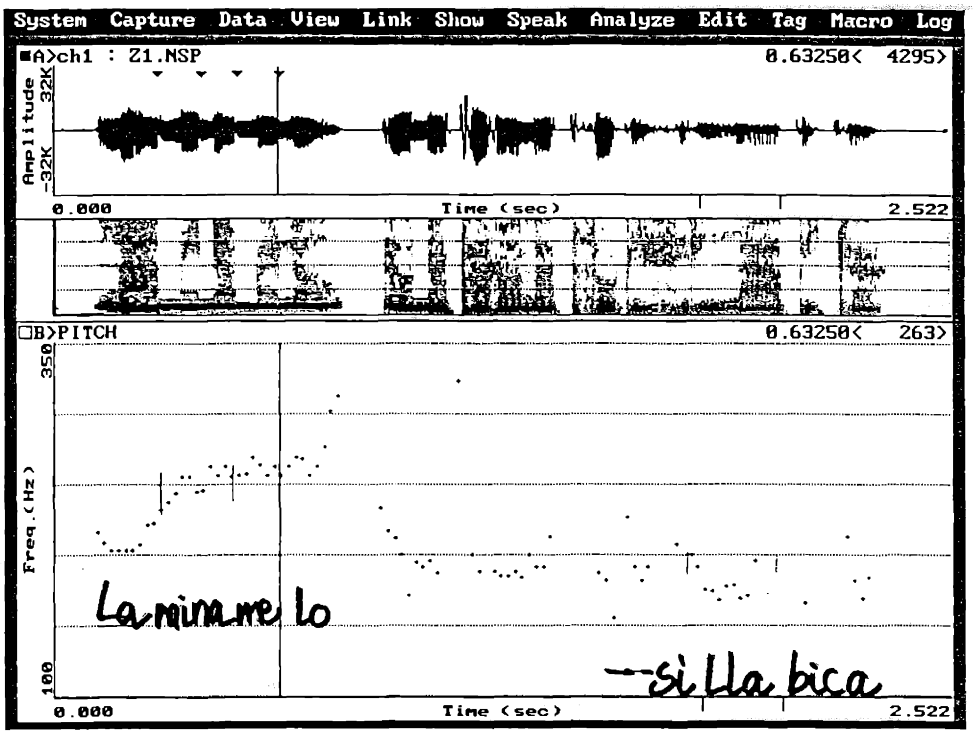



Figure for example (28) **La**minamelo e' una parola plurisi**lla**bica
LH H- L*L-L%

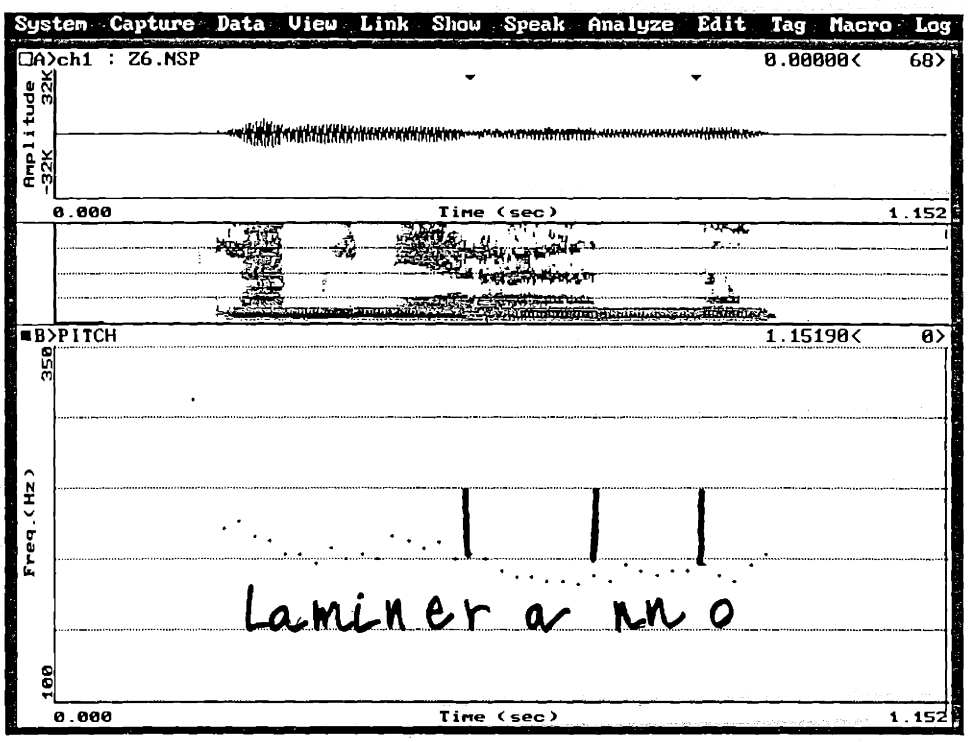



Figure for example (29)

Lamine**ra**nno
L*L-L%

Looking at the figures showing the waveforms, spectrograms and F0s on the preceding pages and the associated tonal transcriptions we see that each utterance has been analyzed as composed of either two intermediate phrases, as in most of the utterances, or one intermediate phrase within an intonational phrase, as in (22), (23), (24), (25), (27) and (29). What this translates into is, in the first case, two intermediate phrases with their own nuclear accents (the notion of nuclear accent is defined in terms of the intermediate phrase) and phrase tones, or, in the second case, one intermediate phrase and just one nuclear accent. In fact, the two words which carry the nuclear accents feel equally prominent; this wouldn't be so if these utterances had just one intermediate phrase and thus just one nuclear tone. In this second case the word carrying the nuclear (last) tone would feel more prominent than any other preceding word, even if such a word were associated with a H tone. Further, that (22), (23), (24), (25), (27) and (29) (and sentences structurally similar to these) are instances of just one intermediate phrase is confirmed by two different claims, taken together, that have been made in the literature: a proposal to equate the Intermediate Phrase with the Phonological Phrase (Hayes and Lahiri, 1991) and the claim that Stress Retraction in northern varieties of Italian is a Phonological Phrase internal rule (Nespor and Vogel, 1986). The sentences above do not have the right environment for application of the rule but sentences such as (30) and (31) below do and Stress Retraction is operative, showing that there is no boundary between the verb and the post-verbal subject or the verb and the prepositional phrase respectively.

(30) Arrívera Mónica < Arriverà Mónica
arrive-will-3rd p.s. Monica

(31) Arrívera a Mónza < Arriverà a Mónza
arrive-will-3rd p.s. in Monza

I will begin by discussing the nature of the last tone within the intonational phrase, appearing in all examples, since its status appears to be less controversial than the tone found utterance initially in some of the utterances. The tone associated with the last syllable within the intonational phrase, is L. This tone is posited to be mapped onto the last nuclear syllables in declaratives with broad focus. If we look at the figures for examples (23), (24), (25), (27) and (29) we see that the F0 contour falls to a L target, towards the second half of the accented syllable, the middle of the vowel. This L tone has a value that ranges from 167 Hz to182 Hz across all utterances. In principle, all the examples above have this L tone but because it lies at the end of the utterance it is harder to see in longer sentences where the tonal targets L- and L% are pulling the F0 downward as well.

The tone which is the correlate of the intonational phrase boundary is always a L% tone. Whenever the intermediate phrase is contained within the intonational phrase there will be a L- tone too, correlate of the intermediate phrase, preceding the L%. In these cases though the separate influence of these two boundary tones will not be discernible due to fact that each L target will be realized with the same F0 value.

The pitch accents on the subjects are correlates of F0 movements which cannot be left unanalyzed. These pitch accents are posited to be LH tones. If one looks at the F0

contour for all preverbal subjects (examples (16)-(21), (26), (27), (28)) the L target is usually aligned with the left edge while the H target is usually aligned with the right edge of the accented syllable or with the following one. I will refer to the lexical items bearing this tone as Topics. In example (19) the subject is clearly a Topic given the resumptive pronoun coindexed with it in the following Intermediate Phrase. This subject has the same F0 contour as all the ones which are not contrastively focused. We will see that the tone associated with the accented syllables of these Topics surfaces in other phrases as well.

The LH tone found on Topics cannot be a L*+H tone and nor can it be a L+H* tone. By definition, a L*+H tone consists of a low valley within the accented syllable and a peak at a constant delay. If we look at the F0 contour for all of these preverbal subjects, we see that the valley is aligned with the left boundary of the accented syllable. Similarly, the H peak is at the right edge of the accented syllable and most of the time it occurs within the next syllable. Example (19) and (28), to take two clear cases, show this transparently: the valley is aligned with the left edge and the peak on the syllable following the accented one. I will discuss the F0 contour following this rising contour below.

The possibility of this LH tone being a L+H* is also excluded, if one takes the notation seriously. The F0 associated with such a tone would show a peak spanning the whole accented syllable immediately preceded by a relatively sharp rise from a valley in the lowest part of the speaker's range. If we look at the F0 contour of all of the preverbal

non-focused subjects the prediction is not borne out. An even closer look at the F0 on these subjects brings one to a puzzling conclusion.

What is puzzling is that what seems to be relevant for tone mapping, or alignment, includes the preceding and following syllables with respect to the accented one, given that the rise spans the accented syllable but usually begins before it and ends after it. In cases where the accent falls on the first syllable of the word, as in examples (16) and (28), the L target will be within the accented syllable since there is no preceding syllable and the H target will be on the following one. If one were to examine only words with an accent in initial position then this sequence could be confused for a L*+H tone. However, if one looks at cases where the accented syllable is not in initial position then the L target will be, as discussed above, either at the right edge of the pre-accentual syllable or at the left edge of the accented one (or, alternatively, the valley will be positioned right at the boundary). This tonal sequence is not found in (23)-(25) where the sentences have post-verbal subjects. We can confidently say that the LH tone is not merely mapped onto initial lexical items because otherwise *Arriva* would bear such a tone. We can also confidently say that it is not indiscriminately mapped onto subjects since *Maria, Giovanni* and *Domenico*, respectively, do not show the characteristic F0 associated with it.

In words which have more than one syllable after the accented one we see that the F0 continues to stay high after the H target of the LH tone, as in (19) and (28). This is posited to be the result of spreading of the H of the LH tone: the phrase tone controls the F0 between the last pitch accent of the intermediate phrase (H) and the beginning of the next intermediate phrase. The resulting high plateau, consequence of the trailing H of the

LH sequence and the H- phrase tone, can be seen in examples (17)-(21) and (28), where there is enough post-accentual material for spreading to be detected. The H spreads until the H- phrase tone. If there were no H- then the F0 after the H in LH would fall to about 200 Hz immediately, as it does after the end of the word. This is especially clear in (28) where the accent is on the first syllable of the word but the F0 stays high until the end of the word (clitic *–lo* included).

An alternative would be to analyze the F0 contour on these subjects as a L* pitch accent on the accented syllable. The F0 will then proceed upwards as a result of a H- phrase tone. However, if this were so we would expect a steady rise after the low target, ending at the end of the word. If we look back at example (28) we see that the steady rise ends on the postaccentual syllable where spreading begins until the H- is reached. A clear counterexample to the L* alternative is (21) where we would expect a L F0 minimum followed by a rise on the last syllable of *Marilu'*. Instead we see that the L is well before the last accented syllable. This example shows well that there is indeed a L target before the H and thus that the pitch accent in question is not a simple H* or a simple L*.

A question arises as how to account for the fall after the H- in the cases we have looked at so far, e.g. in (28). One possibility is that there is a L% boundary tone after the H- and that the break after the words carrying the LH tone is so long as to warrant the existence of an intonational phrase. However, the sequence H-L% would result in a high target followed by a low target *before* the end of the word. What we actually see though is a fall after the end of the word. The fall occurs after the subjects and is completed at the end of the first syllable of the first word in the second intermediate phrase, usually a verb.

In addition, a H-L% sequence would introduce a tone associated with an intonational phrase boundary which is not independently motivated.

In order to better answer this question it is worth summarizing which F0 contours are possible between two tones: the F0 can take a direct course as in the possible sequence L*.....H* (interpolation); the F0 can also continue level as it does between a L phrase accent or trailing tone of a bitonal tone and a H% where it rises at the last instant (spreading + final rise); the F0 can dip down between two H tones even without an intervening L. Interpolation involves syllables left unspecified with respect to tones and entails a smooth rise or fall; it also predicts the dip between two H tones. By contrast, spreading involves syllables which are specified with respect to tone. All syllables having the same spreading tone will be at the same level.

Now, the fall after the H- might lead one to posit a L tone early on in the VP which follows. If there were no tonal specification between the H- and the nuclear L on the last word of the sentence then we would expect a gradual fall between the H- and the L. It is difficult to tell whether the F0 is falling because of a L target on the verb or because of interpolation. I will leave this question open.

All non-initial VPs recorded display a narrowing of the pitch range. So do INFLPs whenever they do not coincide with the first intermediate/intonational phrase. For example, in (32) below, we see that the LH tone on ***Anemone*** (the one found on Topic Subjects) is compressed, the pitch range is modified with respect to the previous one: it is much narrower. This compression could be due to a lowering of the voice but it could also be due to the fact that the LH on ***Anemone*** has to be relatively less prominent than

the LH in the intermediate phrase preceding it because of some linguistic (not paralinguistic) requirement. Notice the sequence of LH tones mapped onto the three initial lexical items and notice that only the third one is a grammatical subject while the first two are adverbs. Again, there is evidence to believe that the LH sequence is not exclusively mapped onto subjects. Example (33) is included for comparison with (32): it is clear that the addition of Anemone in (32) changes the F0 course.

(32) Do**ma**ni e dopodo**ma**ni A**ne**mone andra' in **ma**cchina
Tomorrow and the day after tomorrow Anemone will go by car

(33) Do**ma**ni e dopodo**ma**ni andremo in **ma**cchina
Tomorrow and the day after tomorrow we will go by car

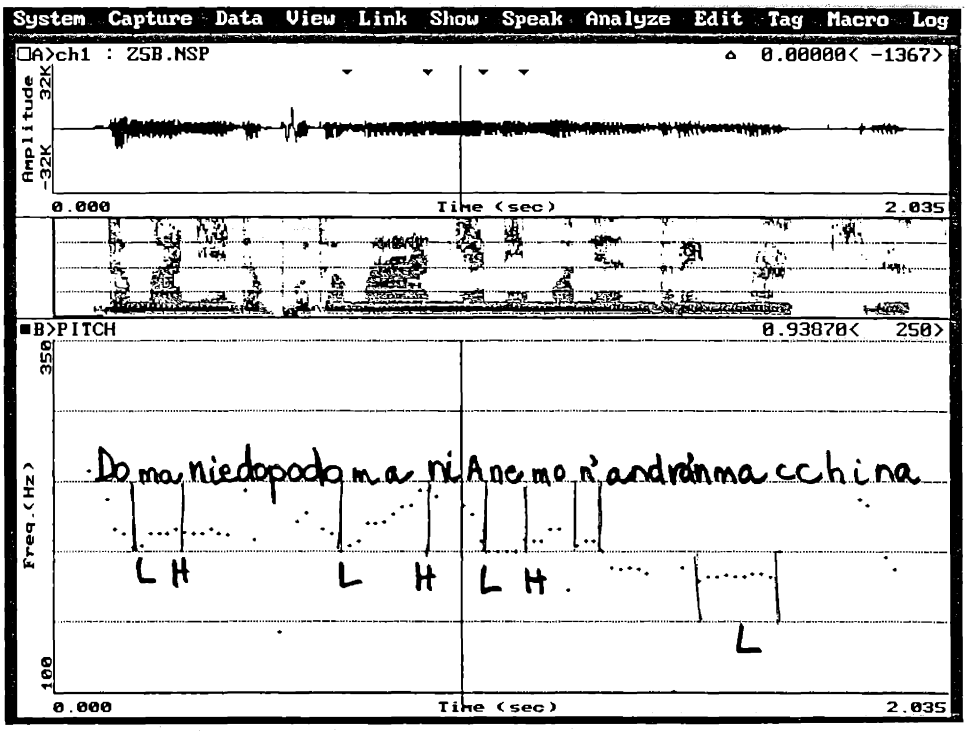



Figure for example (32) Do**ma**ni e dopodo**ma**ni A**ne**mone andra' in **ma**cchina
LH H- LH H- LH H- L L-L%

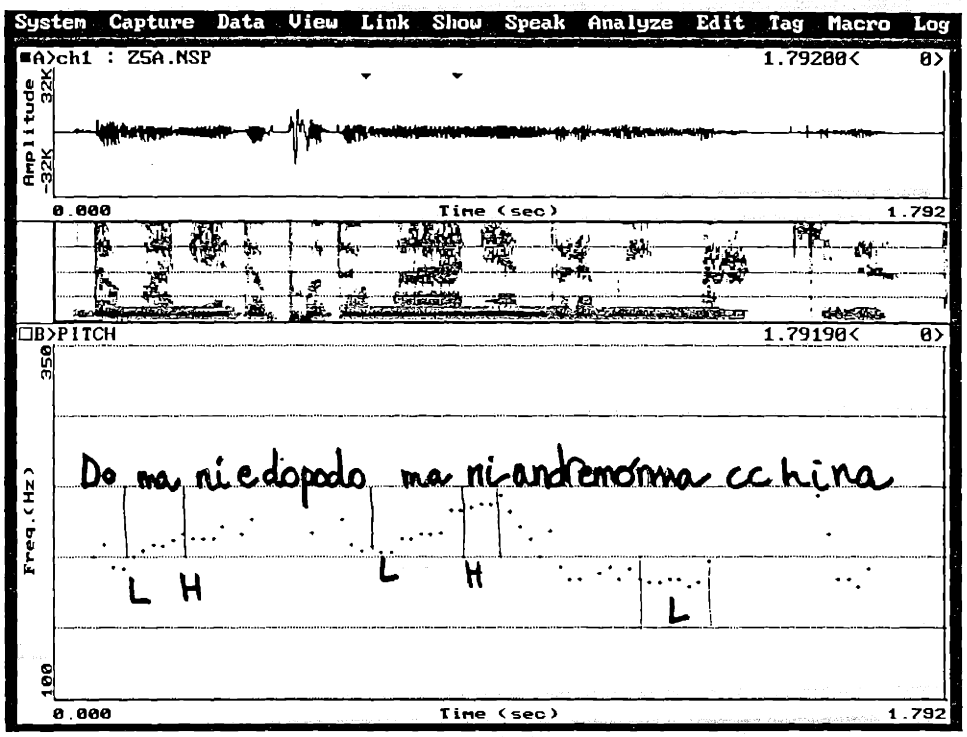



Figure for example (33) Domani e dopodomani andremo in **ma**cchina
LH H- LH H- L L-L%

*5.1.2 An alternative analysis: LH is a prenuclear tone*

There is one alternative analysis for the F0 contours found on Topics which is supported by the data. The analysis is the same as the one that has been put forward by Arvaniti et al. (1998) regarding the LH tone found in Modern Greek where the L and the H of the LH sequence are aligned to specific segmental targets and not with respect to each other. Specifically, the L is always aligned with the beginning of the accented vowel and the H is always aligned with the postaccentual vowel. This analysis eliminates the need for the H- phrase tone and makes the LH tone a prenuclear accent instead of a nuclear one. This is so because nuclear accents, by definition, are always followed by a phrase tone, while prenuclear accents are not. If one looks at the all the examples with an initial Topic one sees that indeed the H target always aligns with the postaccentual vowel independently of how long the interval between the accentual vowel and the postaccentual vowel is. Clear examples of this are (17)-(20). If the position of the H is found to be stable across all utterances then there is reason not to posit a H- phrase tone. However, there are two examples, namely (21) and (28), where the analysis without the H- phrase tone does not account for the data. In (21) *Marilu'* should have mapped onto it a L at the beginning of the last syllable and a H onto the first syllable of the verb following *Marilu'*. What we see instead is a peak mapped onto the accented syllable instead of the one following it. The presence of the peak on the accented syllable might follow from a requirement that both the L and the H must be mapped onto the same lexical item. But what about the F0 contour on *Laminamelo* in (28)? Here we would expect a fall after the postaccentual

vowel *mi*, instead what we see is that the F0 stays high; just what we would expect if there is a H- phrase tone at the end of the word. Admittedly, it could be the case that the presence of the clitic *–lo* is somehow crucial to the course of the F0 in that it could associate with the H and thus give rise to the high plateau between the postaccentual vowel and it. Both analyses are consistent with most of the data modulo some independent assumptions about the mapping of the tonal string and the segmental string.

### *5.1.3 Declaratives with narrow focus*

In order to facilitate comparisons the same sentences as the ones for broad focus have been included in this set. These sentences have narrow focus in initial, medial and final position. Underlining means that the word is focused contrastively.

(34) **Ma**rio mangia una **me**la
Mario eats an apple

(35) Gio**van**ni compra un **mo**bile
Giovanni buys a newspaper

(36) A**ne**mone compra un **mo**bile
Anemone will-buy a table

(37) Do**me**nico nominera' il colpevole
Marilu' will-nominate the perpetrator

(38) **Mo**nica nominera' il colpevole
Marilu' will-nominate the perpetrator

(39) Mari**lu'** nominera' il colpevole
Marilu' will-nominate the perpetrator

(40) Anto**ne**lla compra il Corriere dal giornalaio dell'**an**golo
Antonella buys the Corriere from the newspaper stand at the corner

(41) E' stato il **re** a parlare alla radio
Is-been the king to speak on the radio
It was the king who spoke on the radio

(42) **Ma**rio mangia una **me**la
Mario eats an apple

(43) Gio**van**ni compra un gior**na**le
Giovanni buys a newspaper

(44) Gio**va**nni compra un **mo**bile
Anemone will-buy a table

(45) **La**minamelo e' una parola con cinque sillabe
"Laminamelo" is a word with five syllables

(46) **La**minalo e' una parola con quattro sillabe
"Laminamelo" is a word with four syllables

(47) Lamine**ran**no
will-laminate-3rd p.p.
They will laminate

(48) Arriva Gio**van**ni
Giovanni is arriving

(49) Arriva Do**me**nico
Domenico is arriving

(50) Arriva Mari**lu**'
Marilu' is arriving

(51) Arriva **An**na
Anna is arriving

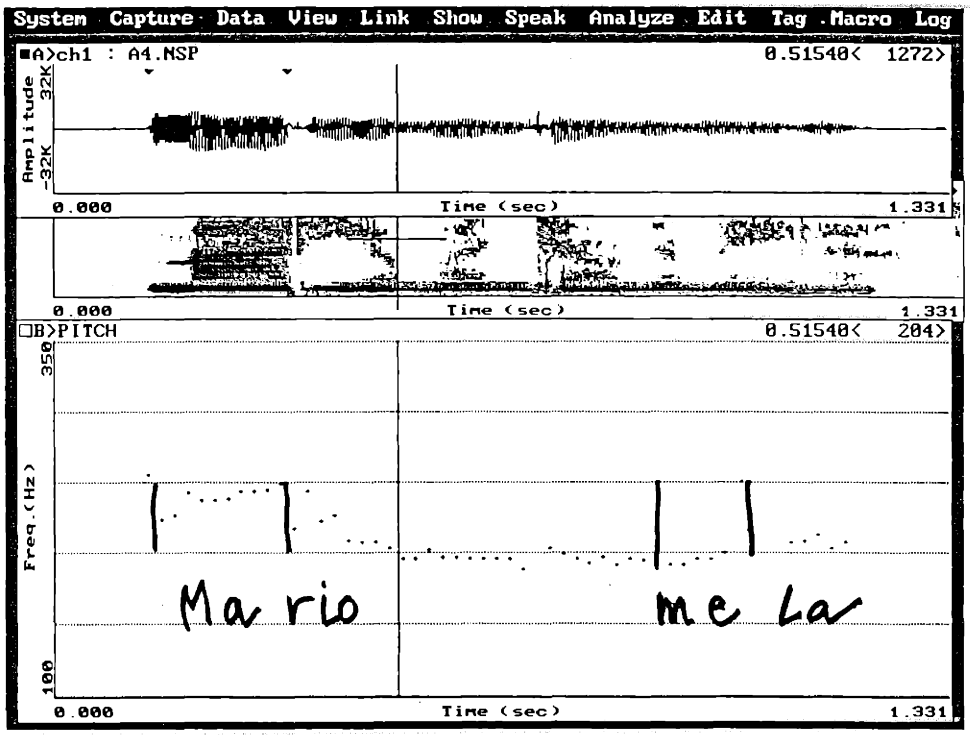



Figure for example (34) <u>Mario</u> mangia una **me**la
LH L- L% L* L-L%

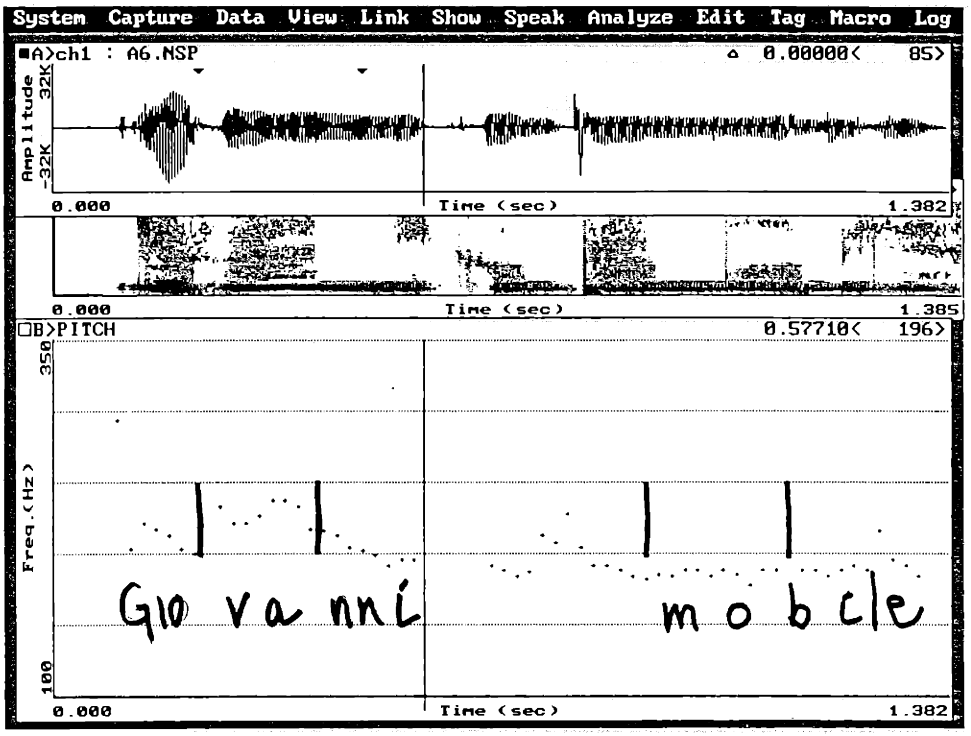



Figure for example (35) Giovanni compra un **mo**bile
LH L-L% L* L-L%

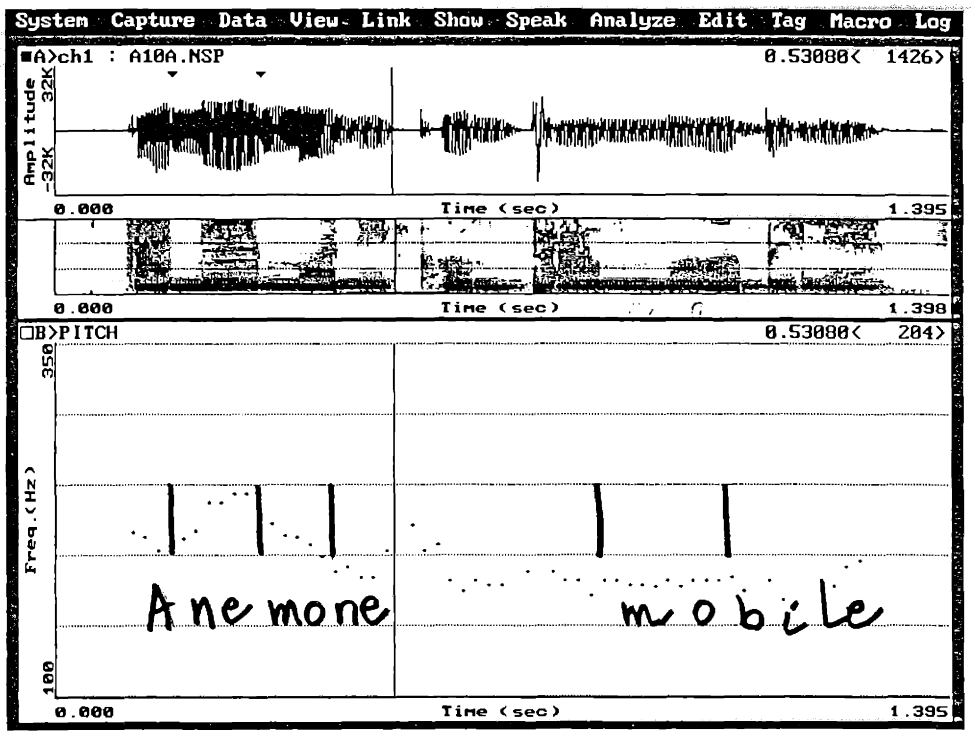



Figure for example (36) <u>Ane</u>mone compra un **mo**bile
LH L- L% L* L-L%

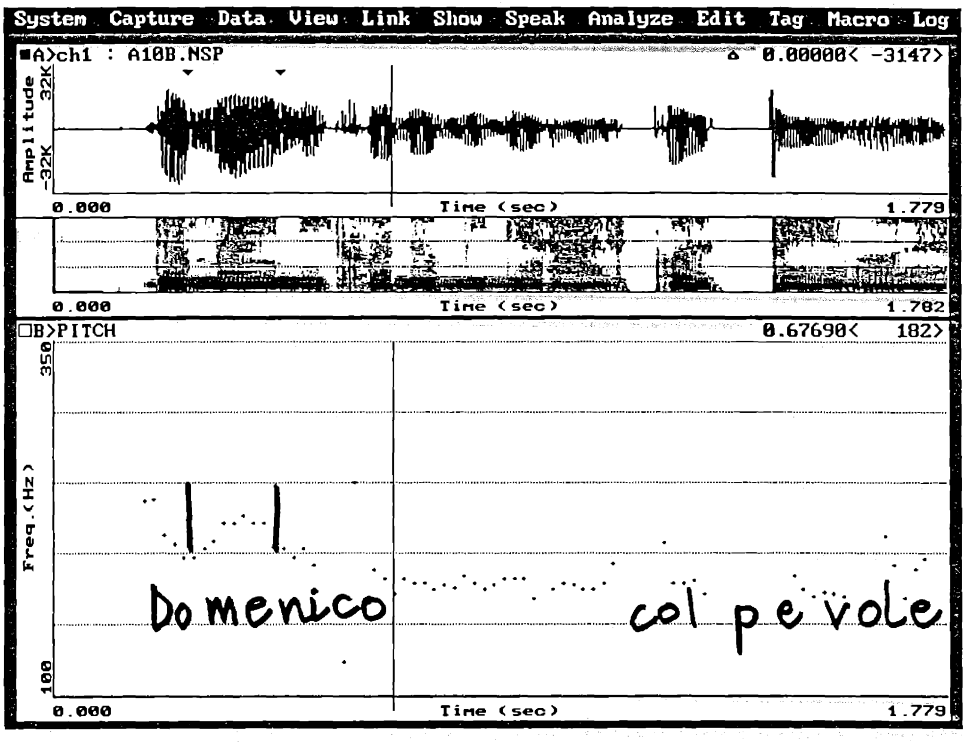



Figure for example (37)

<u>Dom**e**nico</u> nominera' il col**pe**vole
LH L- L% L* L-L%

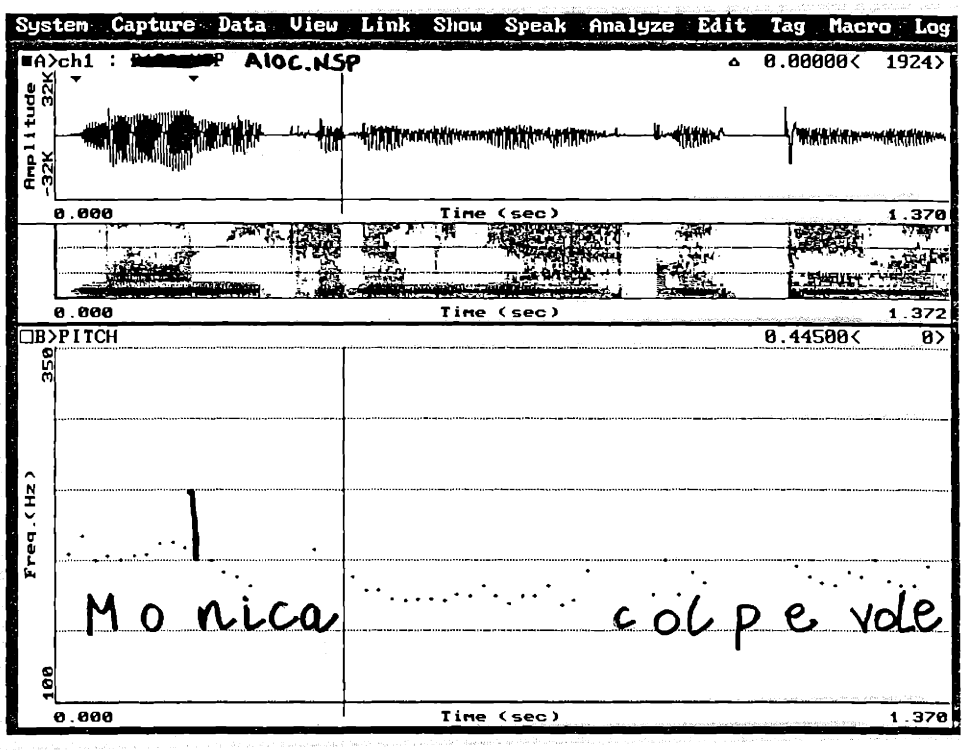



Figure for example (38) Monica nominera' il colpevole
LH L- L% L* L-L%

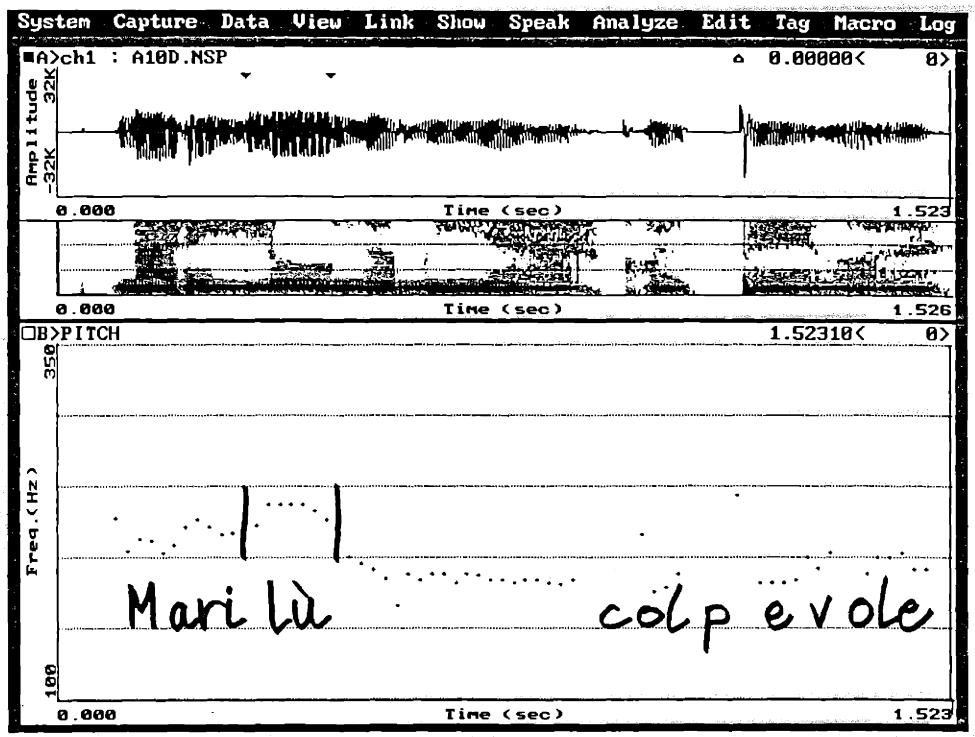



Figure for example (39) Mari**lu'** nominera' il col**pe**vole
LH L- L% L* L-L%

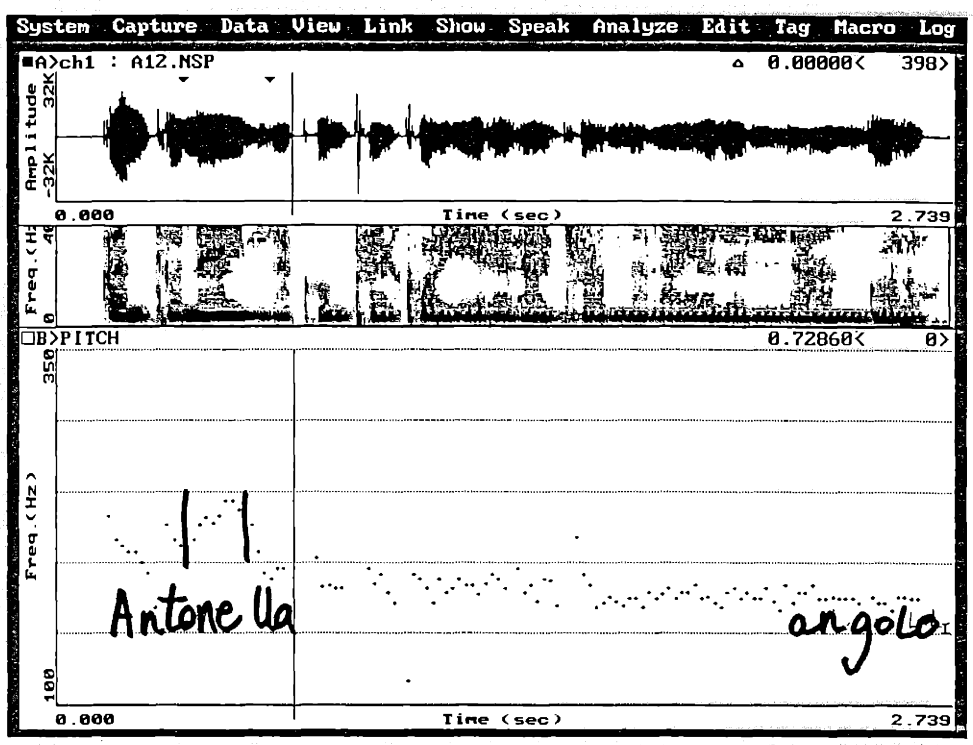



Figure for example (40) Antonella compra il Corriere dal giornalaio dell'angolo
LH L- L% L* L-L%

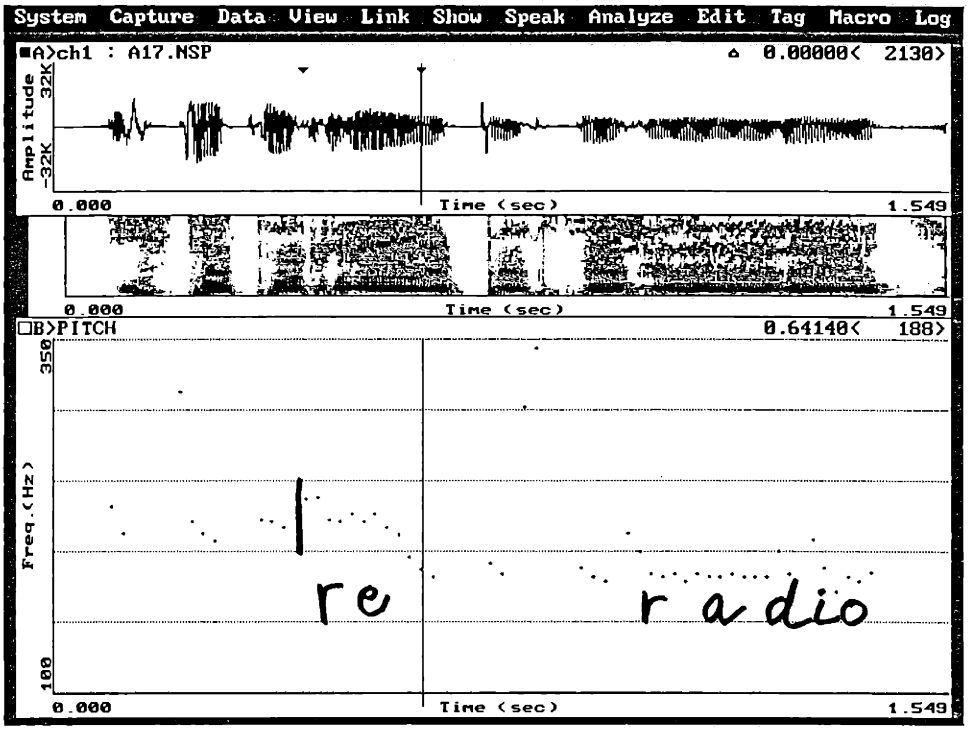



Figure for example (41) E' stato il **re** a parlare alla **ra**dio
LH L- L% L* L-L%

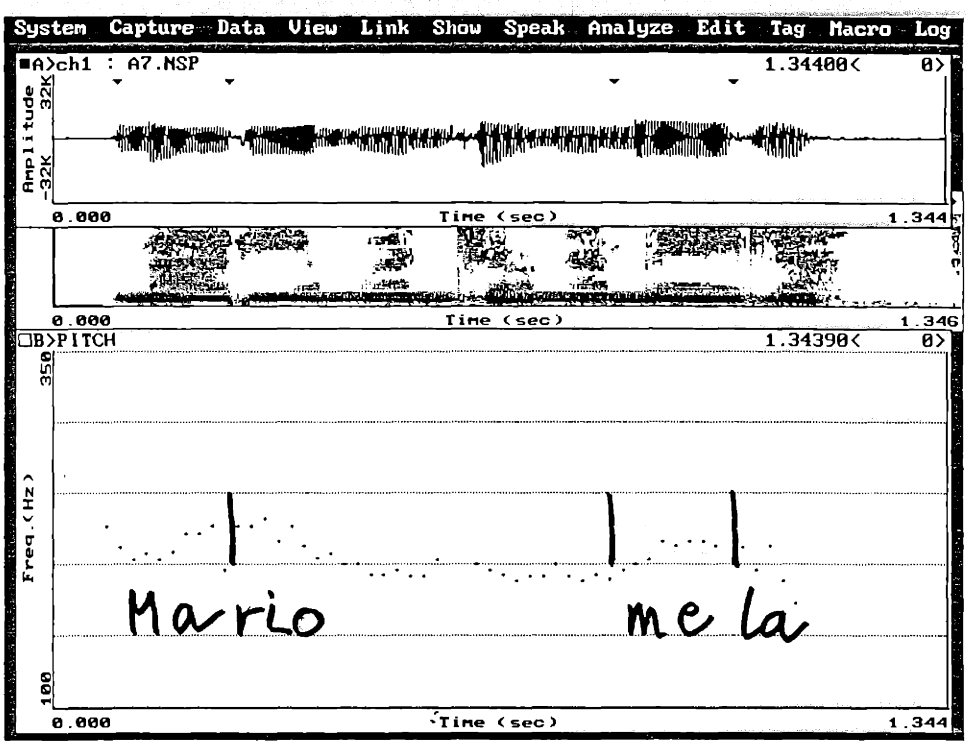



Figure for example (42) **Ma**rio mangia una **mela**

LH L- L%

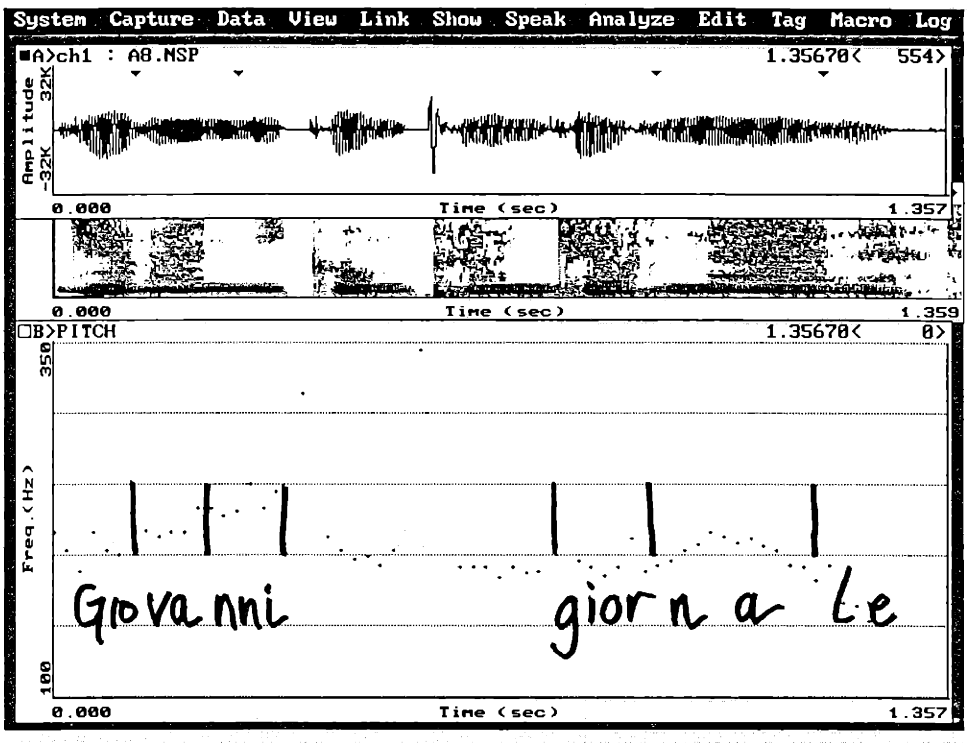



Figure for example (43) Giovanni compra un giornale

LH L- L%

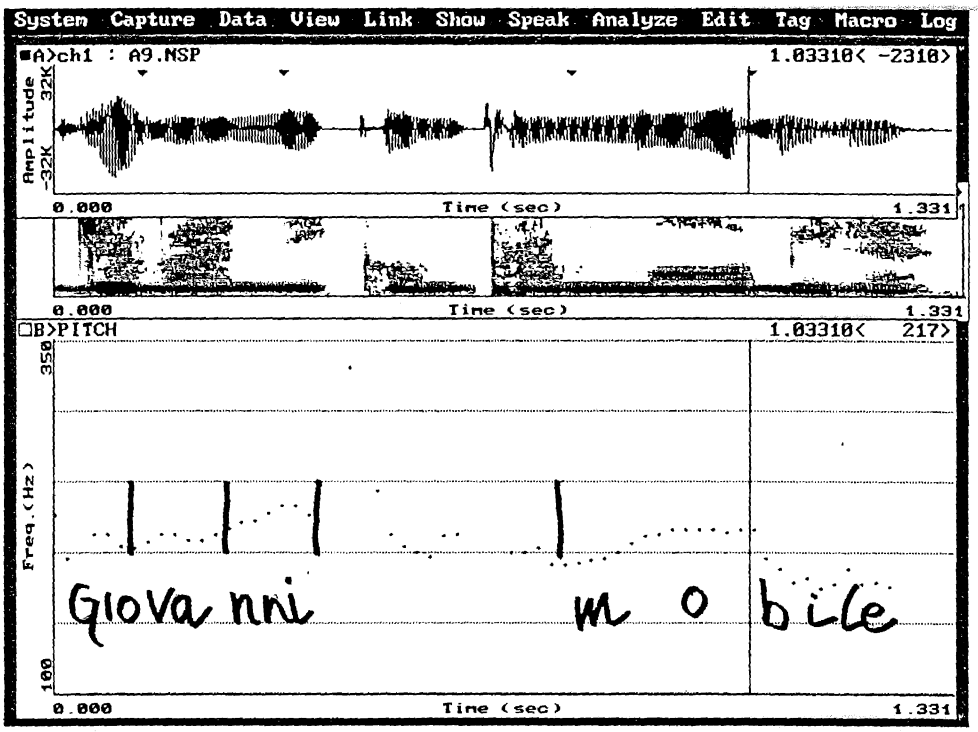



Figure for example (44) Giovanni compra un **mobile**

LH L- L%

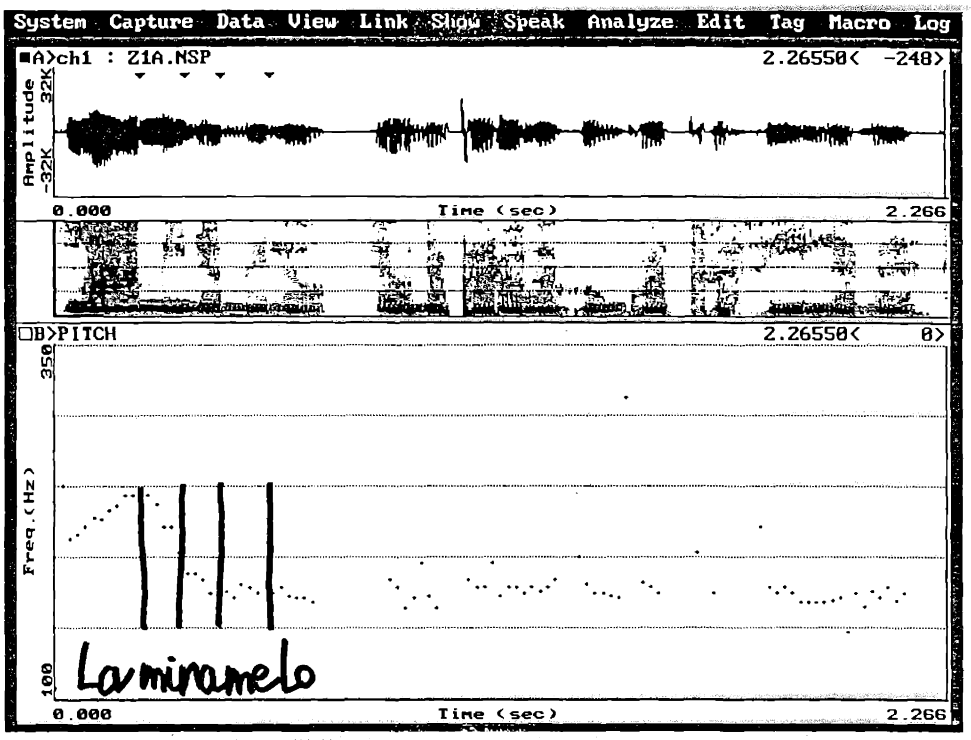



Figure for example (45) Laminamelo e' una parola con cinque sillabe
LH L- L% L* L-L%

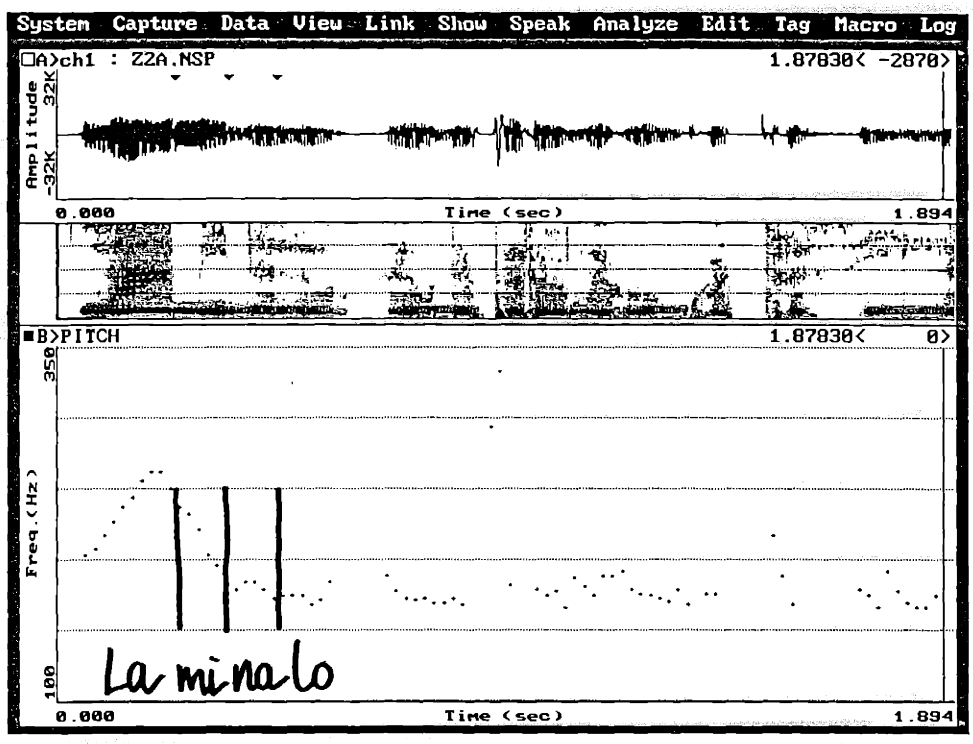



Figure for example (46) Laminalo e' una parola con quattro sillabe
LH L- L% L* L-L%

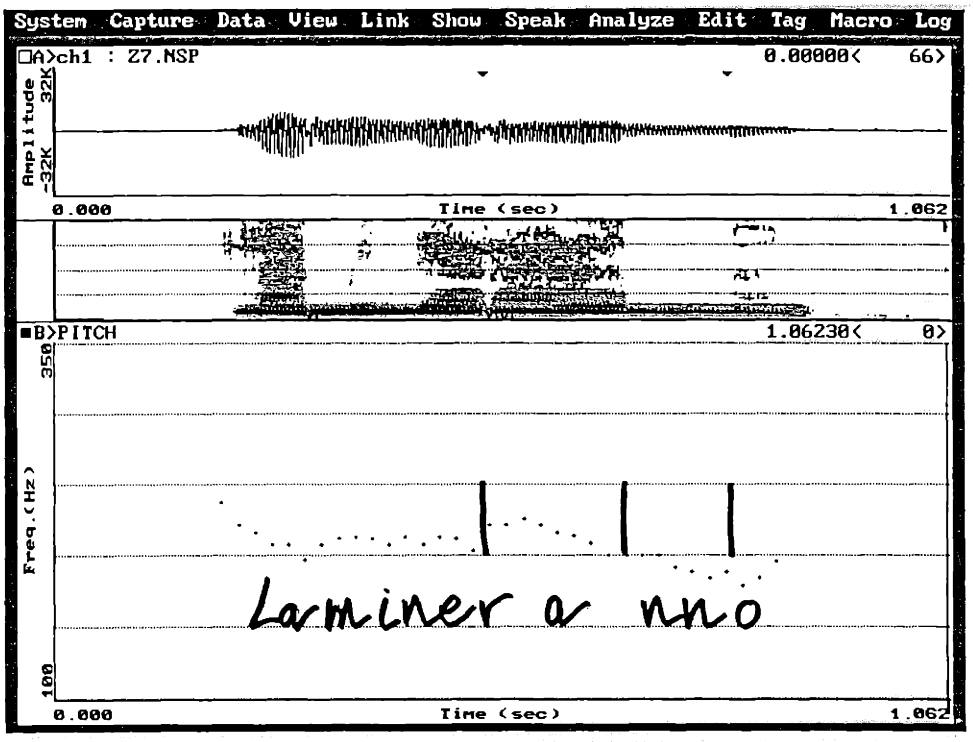



Figure for example (47) Lamineranno
LH L- L%

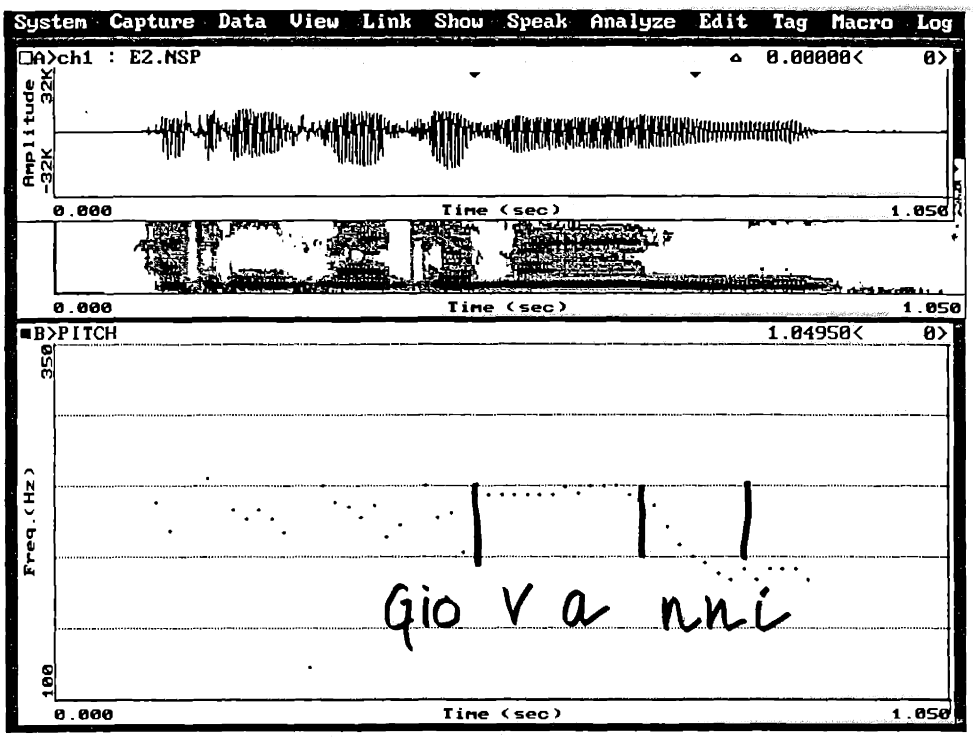



Figure for example (48) Arriva Giovanni
LH L- L%

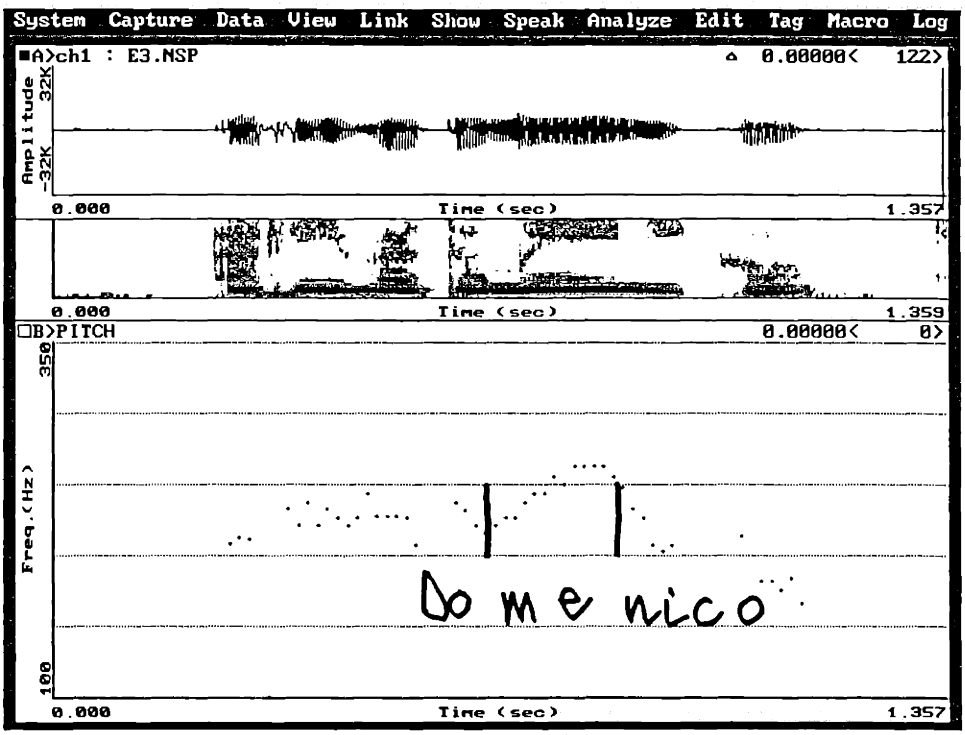



Figure for example (49) Arriva <u>Domenico</u>
LH L-L%

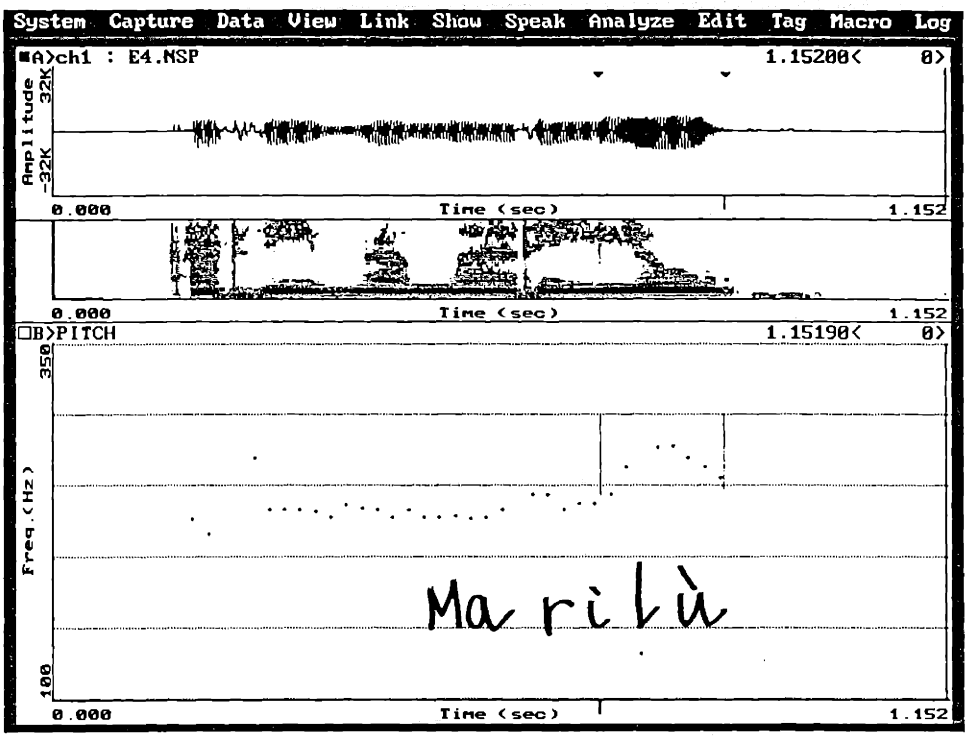



Figure for example (50) Arriva <u>Mari**lu'**</u>
LH (L- L%)

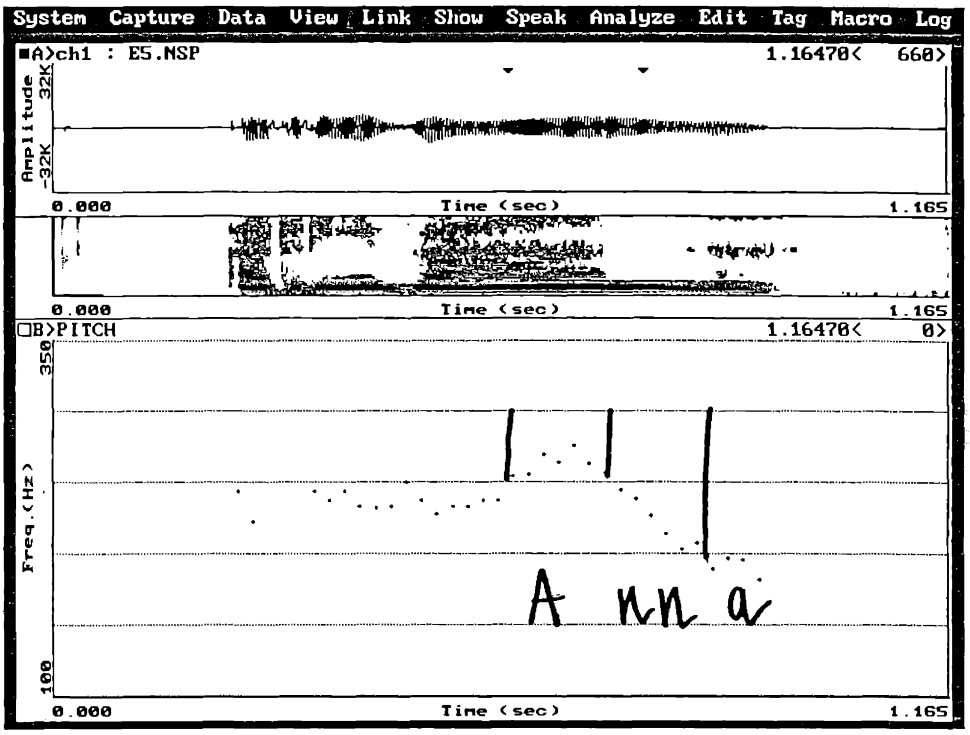



Figure for example (51) Arriva <u>Anna</u>
LH L-L%

For elements that carry narrow focus we see that there is a peak lying within the accented syllable. This tone is a H tone. We also see that for words that carry stress on a syllable after the first one there is the familiar L target at the left edge of the syllable. Indeed this is the same LH tone as the one mapped onto non-focused elements. The difference in the F0 contour lies in the different phrase tone which follows, a difference which I will discuss below. Figures for examples (37) and (39) show very clearly that there is a L target before the H.

The difference between this H tone and the tone correlating with sentential stress is even more obvious. A superimposition of the F0 contour of (29) and (47) shows that until the accented syllable is reached the two F0s follow the same course; at the point where the vowel **a** in *Lamineranno* begins the F0 either rises (for the narrowly focused utterance (47)) or falls; finally, at the end of the vowel the two F0s "meet" again.

Post-verbal subjects focused contrastively also bear the same LH tone. Examples (48)-(51) are instances of VPs with subjects conveying narrow focus and the H tone (not rigidly aligned) is associated with the accented syllables. There is less misalignment of the H tone with the vowel of the accented syllable in these cases; there is independent evidence (work by Pierrehumbert and Beckman, 1988) that just before a L- phrase accent the peak of a H or LH tone tends to come earlier as if to avoid a fall which would be too steep if the H and L- were too close to each other. Across all utterances a pattern emerges: the H tone is well aligned with the accented syllable whenever the accented syllable is close to the end of the word otherwise it shifts to the right edge as the accent retracts. This makes sense, because as the accent shifts to the left there will be more material between

the H and the L- phrase tone which will allow for a more gradual fall. So, for example, in (49), where the accented syllable is in antepenultimate position, the H is aligned at the right edge, in (48) and (51), where the accented syllable is in penultimate position the H is realized as a peak/high plateau spanning the accented syllable, and finally, in (41) where the accented syllable is the only syllable of the word (*re*) the H is aligned at the left edge.

These contrastively focused elements, which not only include pre-verbal and post-verbal subjects, but also NPs in medial and final position in the sentence, are all followed by a L- phrase tone and a L% boundary tone. I propose that these contrastively focused subjects immediately precede the right boundary of an intonational phrase. This is so since the segment of the utterance which ends with the focused element could stand alone, that is, would not have to be followed by further material for it to be pragmatically acceptable. The material which usually follows the focused element has Topic status. It is often referred to as *tag* or *emarginated* material.

I have transcribed the L* nuclear pitch accent on the final word of these utterances but in some cases it is not clear whether the emarginated material that follows the subjects is accented at all. Perceptually, these phrases seem deaccented, fact which can be explained by them denoting "old information". A look at the spectrogram indicates that there is a lengthening of the vowel of the accented syllable sentence finally (the one which normally carries a pitch accent in broad focus utterances), however there seems to be no corresponding pitch accent. These F0 stretches, which by themselves are assumed to form an intonational phrase are *parasitic* on the preceding intonational phrase, that is,

they maintain the F0 value which has been reached at the end of the focused element. We will see that for yes/no questions this translates into a high F0 plateau for the second intonational phrase since the focused element in the first intonational phrase has a H- H% sequence at its boundary. Ladd (1996) has also noted how the F0 for tags in English tends to be determined by the immediately preceding F0 contour. The following are two examples of his (p. 220):

(52) a. Are you coming, she asked.

H* H H H%

b. I don't think so, he said.

L*+H L L H%

The last tone of the main sentence seems to dictate the tonal specification of the tag.

The evidence for positing both L- and L% as edge tones comes from inspection of the F0 values at the end of the fall. In examples (36), (37), (40), (41), (45) and (46) we see that the end of the fall coincides with my baseline, that is, about 180 Hz. These contrastively focused subjects indeed could form an utterance by themselves, as discussed above.

Here too there is an alternative analysis which does not postulate the two edge tones, and thus a separate intonational phrase. In this second analysis the tone in question is a LHL tone. The initial L would be aligned with the beginning of the accented vowel, as it is for the LH mapped on Topics, the H with the accented vowel and the final L with the

postaccentual vowel. Examples (36) and (37) are data that fit this model well. However, this second analysis does not take into account that the focused material is perceptually set off from the emarginated material and that what would be the nuclear word (the last word of the sentence) is not perceptually more salient than the focused item.

If the focused element is sentence-final the phrasing is as follows:

(53)=(44) {[Giovanni ] [compra un **mo**bile ] }

| |

LH L- H L- L%

We can conclude that, in Italian, sentence final stress, for which one cue is the lengthened vowel of the accented syllable, can be realized intonationally differently depending on the semantics/pragmatics that the speaker wants to convey, that is, depending on the informational status of the word carrying final stress.

*5.2 Yes/no questions; broad and narrow focus*

Yes/no questions with no contrastively-focused element differ from declaratives mainly in that the F0 is rising instead of falling.

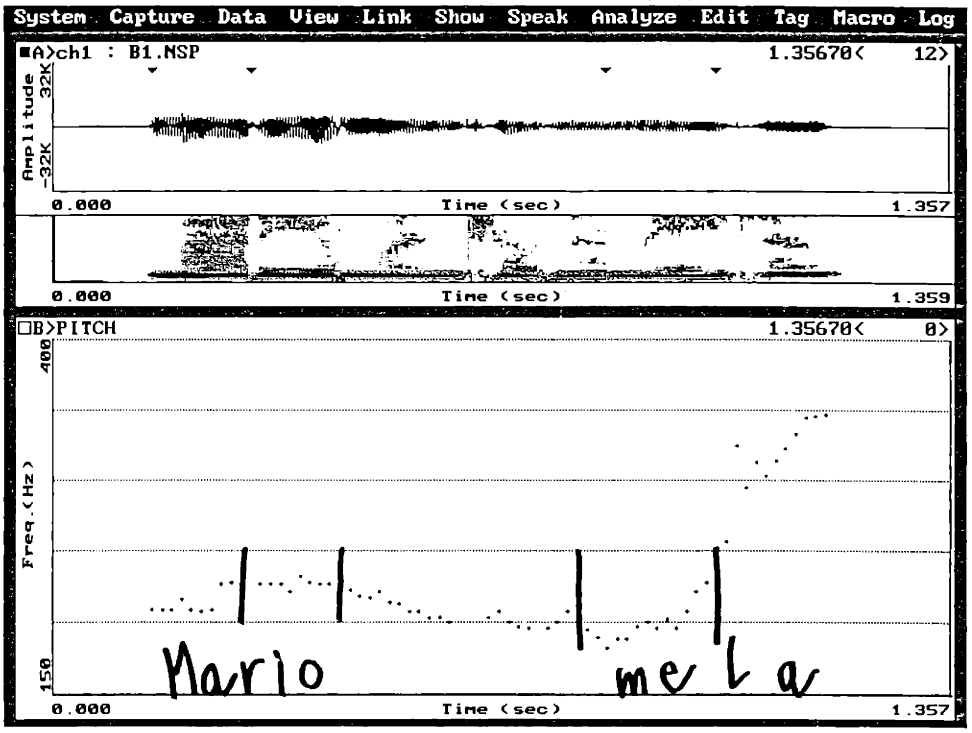



Figure for example (54) **Ma**rio mangia una **me**la?
LH H- L* H-H%

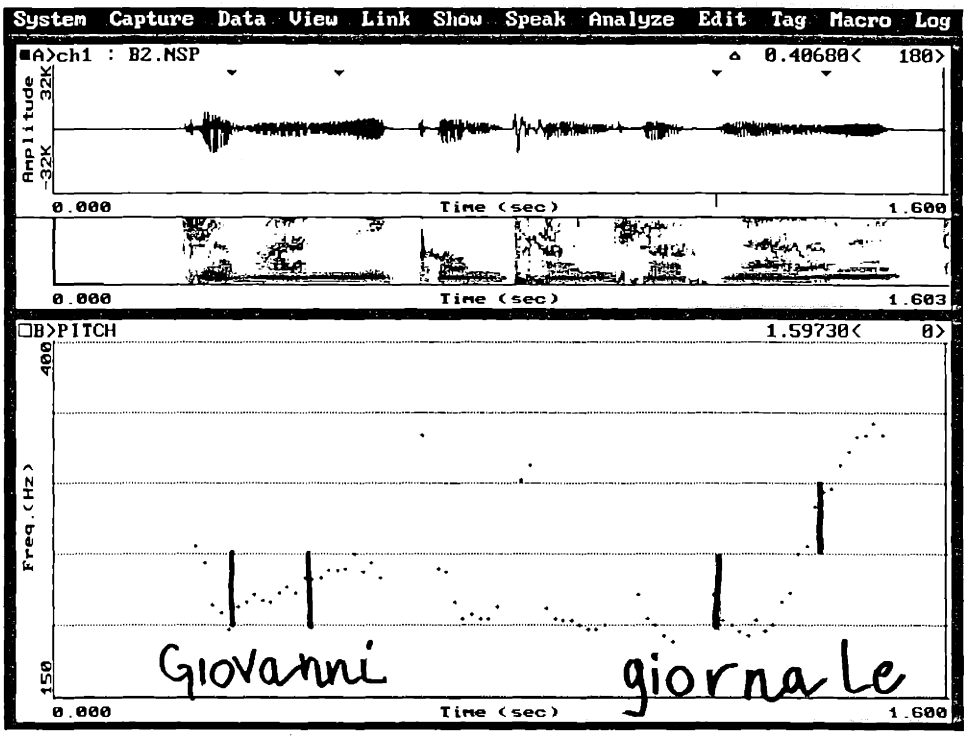



Figure for example (55)

| | | |
|---|---|---|
| Gio**va**nni | compra un gior**na**le? | |
| LH H- | | L* H-H% |

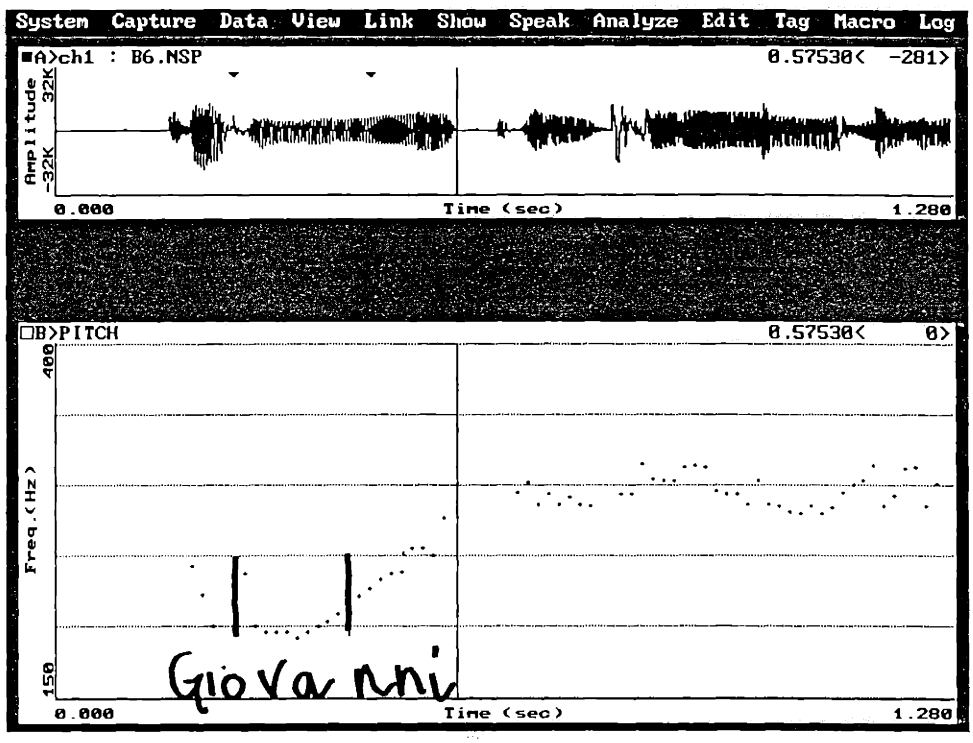



Figure for example (56) Giovanni compra un mobile?
LH H- H%

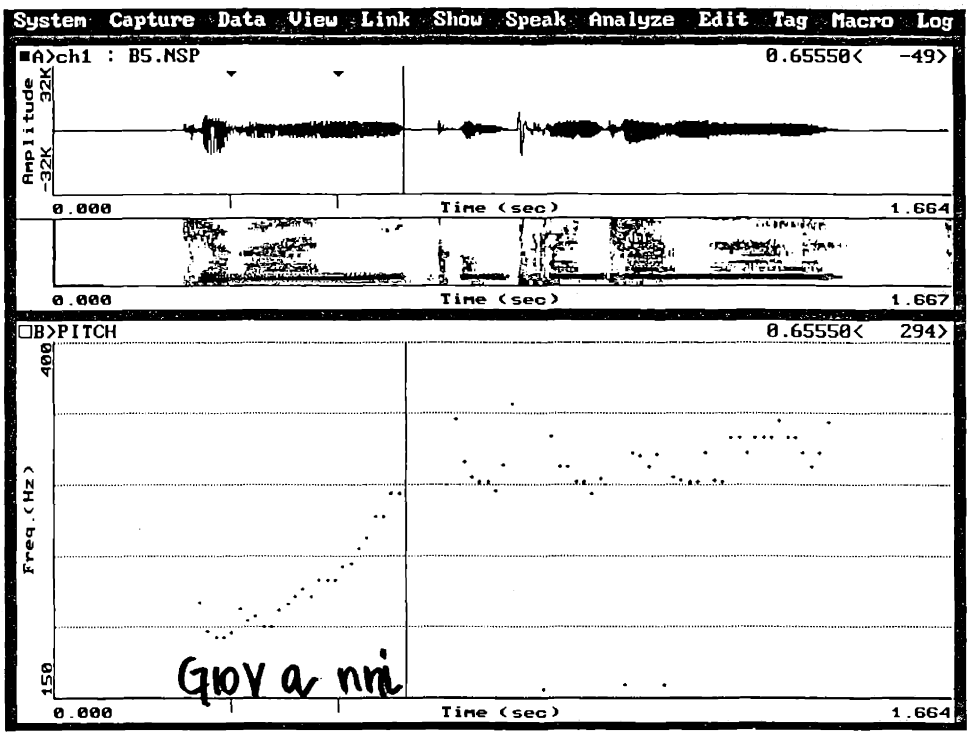



Figure for example (57) Giovanni compra un giornale?
LH H- H%

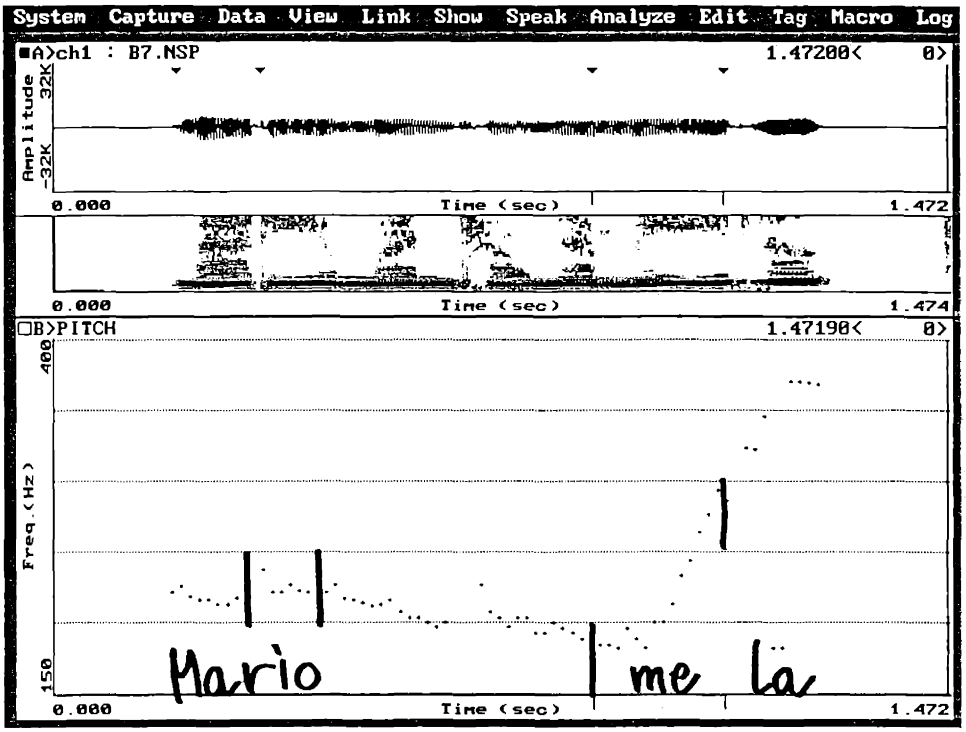



Figure for example (58) **Ma**rio mangia una **me**la?
LH H- LH H-H%

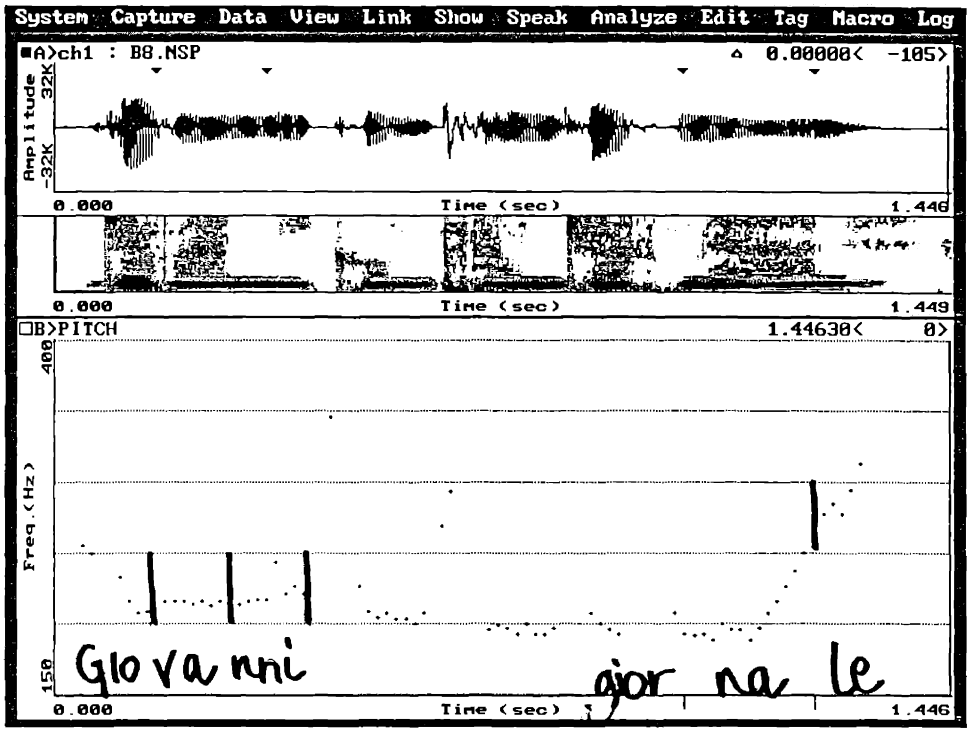



Figure for example (59) Giovanni compra un giornale?

LH H- LH H-H%

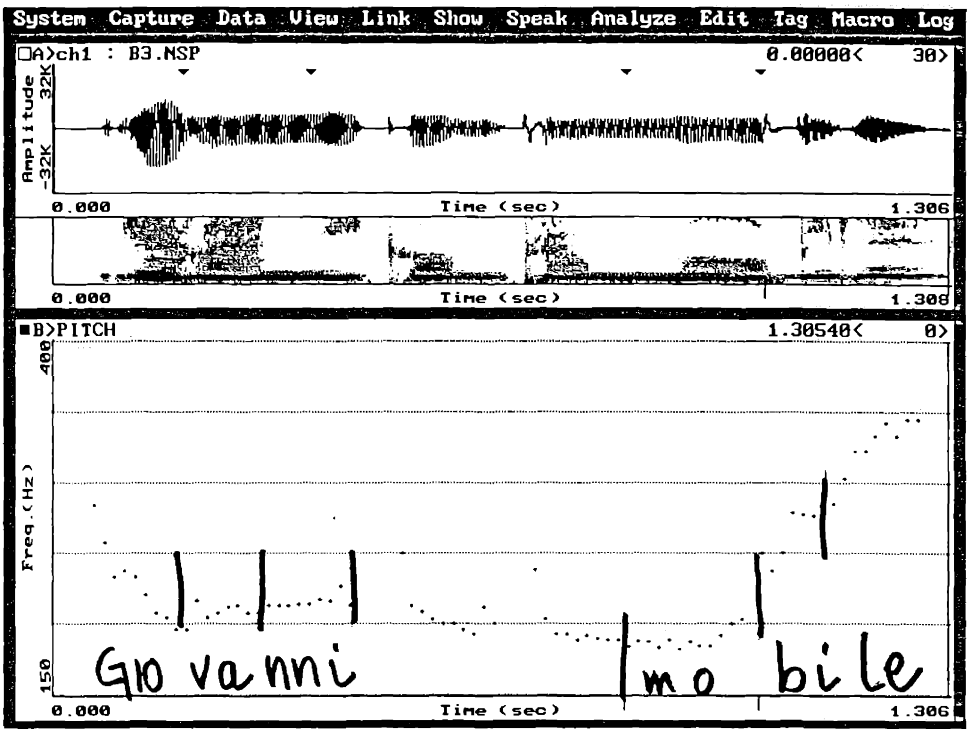



Figure for example (60) Giovanni compra un **mo**bile?
LH H- LH H-H%

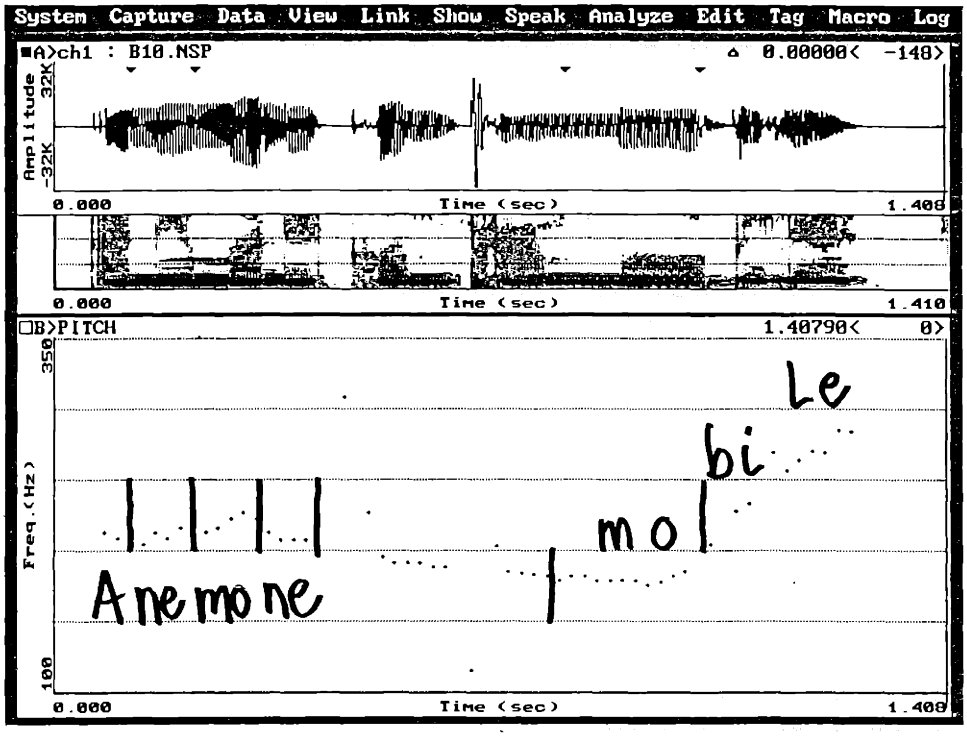



Figure for example (61)

Anemone compra un mobile?
LH H- LH H-H%

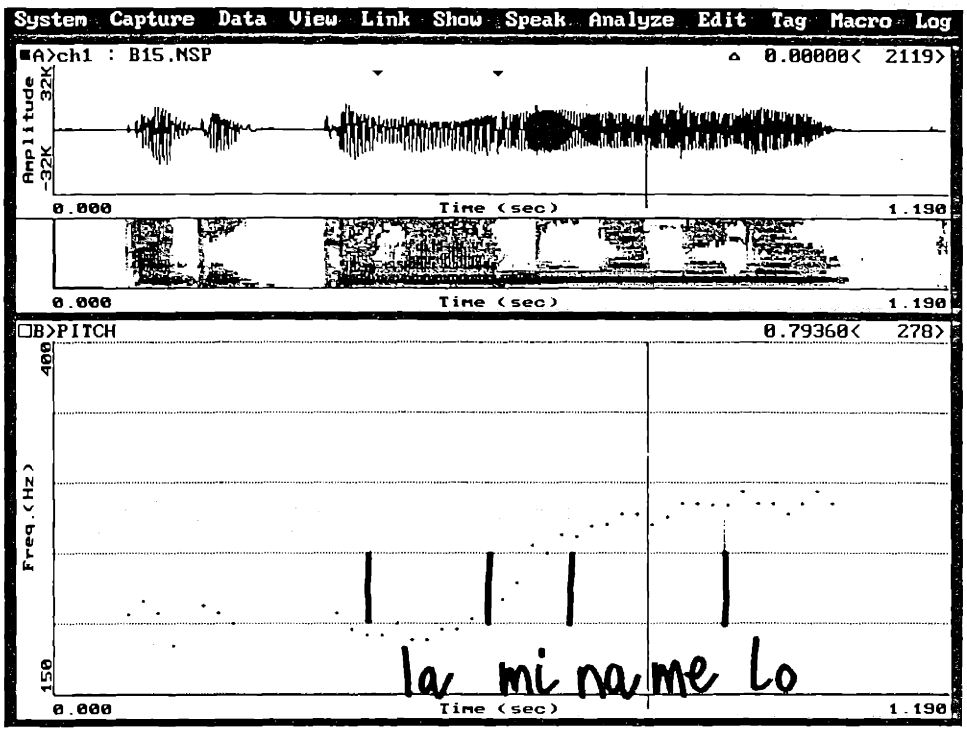



Figure for example (62) Ha detto laminamelo?
LH H-H%

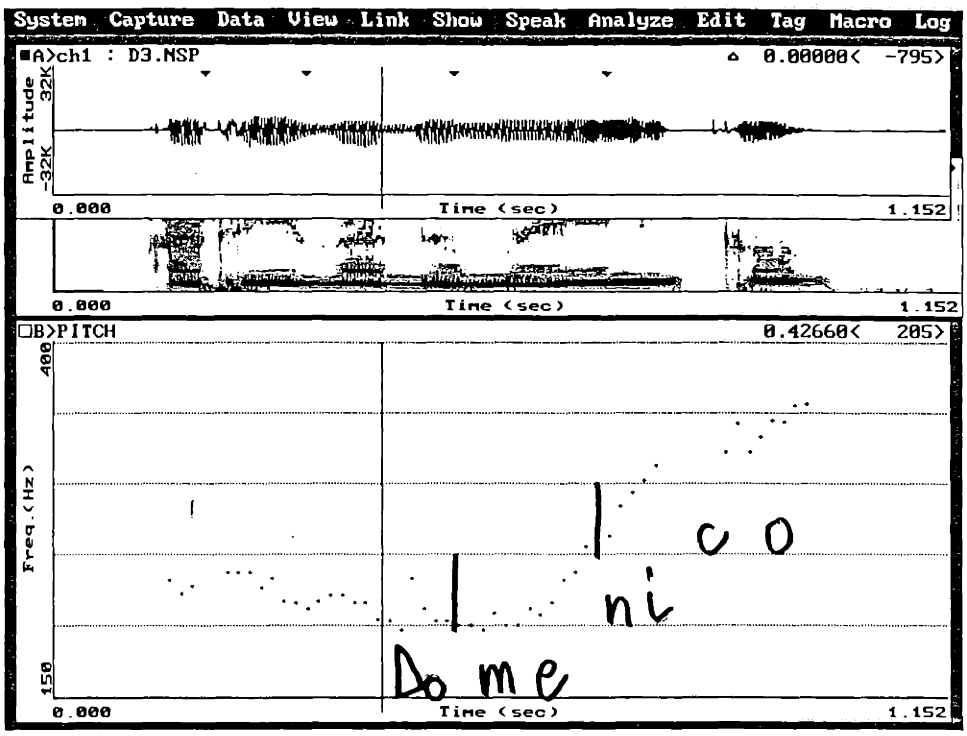



Figure for example (63) Arriva Domenico?
L* H- H%

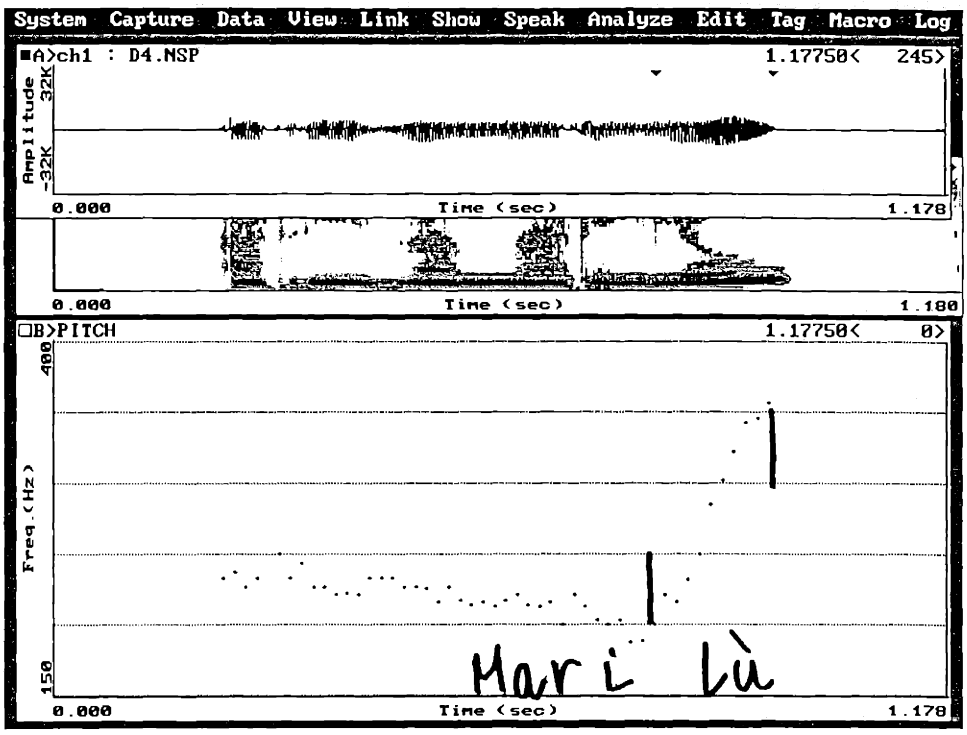



Figure for example (64) Arriva Mari**lu'**?
L* H- H%

The edge tones at the right edge of yes/no questions are H- H% instead of L- L%. Pierrehumbert et al. (1990) identifies this sequence as typical of the end of utterances which are forward-looking in the sense that the utterance has to be interpreted with respect to what follows. As anticipated, Topics in this set of utterances bear the same pitch accent sequence, LH, as do the ones in declaratives. A L tone is associated with the syllable carrying sentential stress (broad focus); (54), (55) and (56) are such cases. A L tone is also associated with the accented syllable of any element carrying contrastive focus as (60)-(63) show. Here it is difficult to say though whether the tone mapped onto yes/no question final focused constituents is a L* or a LH tone since both of these tones followed by a H- H% sequence would result in a high rise of the F0. However, if one takes into account that a H- phrase accent is downstepped if followed by a preceding H tone which is part of a bi-tonal nuclear tone, as it is in this case, then the LH sequence is not supported by the data. In fact, the F0 rises steadily and does not downstep after the accented syllable. For focused elements early in the utterance the analysis is the same except for the fact that there is a second intonational phrase, the emarginated material, which maintains a high F0 throughout. This parasitic behaviour was also seen above in declaratives.

*5.3 Wh-questions*

The following is an ambiguous wh-question in Italian with its two different interpretations indicated by the glosses:

(65) Qual' animale ha ucciso il cacciatore?

Which animal has killed the hunter
a. Which animal killed the hunter?
b. Which animal has the hunter killed?

The ambiguity lies in whether the preverbal noun is the subject or the object of the sentence. It turns out that (65) and wh-questions like it can be disambiguated prosodically quite effectively. The following figures show the two different renditions of the utterance:

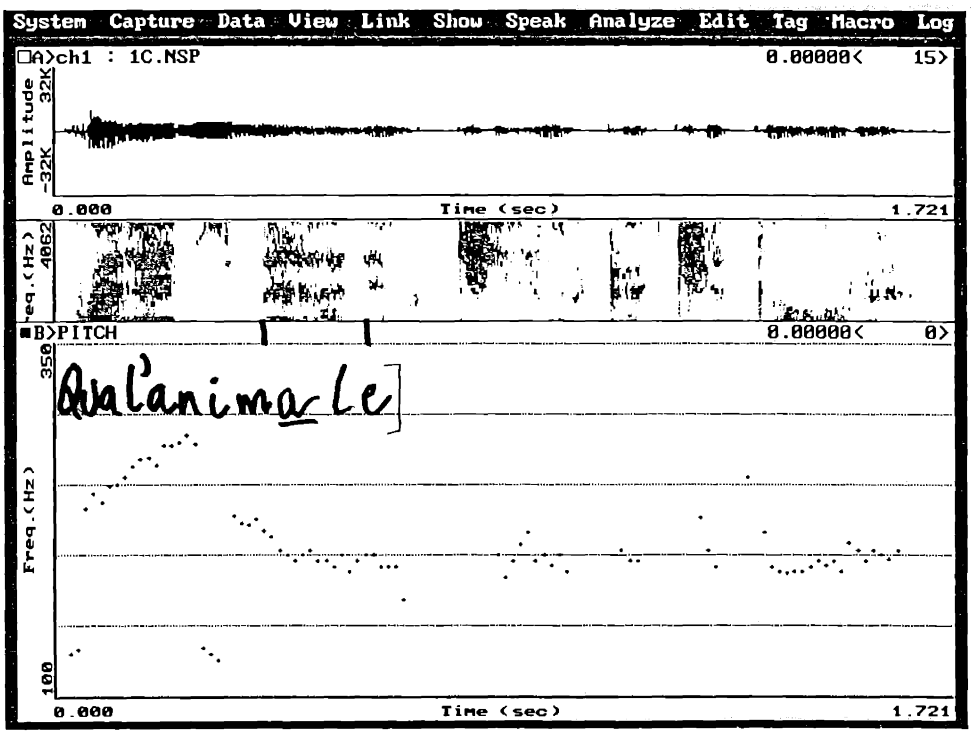



Figure for example (65) with interpretation a. (and b.)[6]
Quale anim**a**le # ha ucc**i**so il cacciatore?
LHH- (L*)L-L%

[6] It is still unclear at this point whether this F0 is associated with interpretation (a.) exclusively or whether it also allows interpretation (b.)

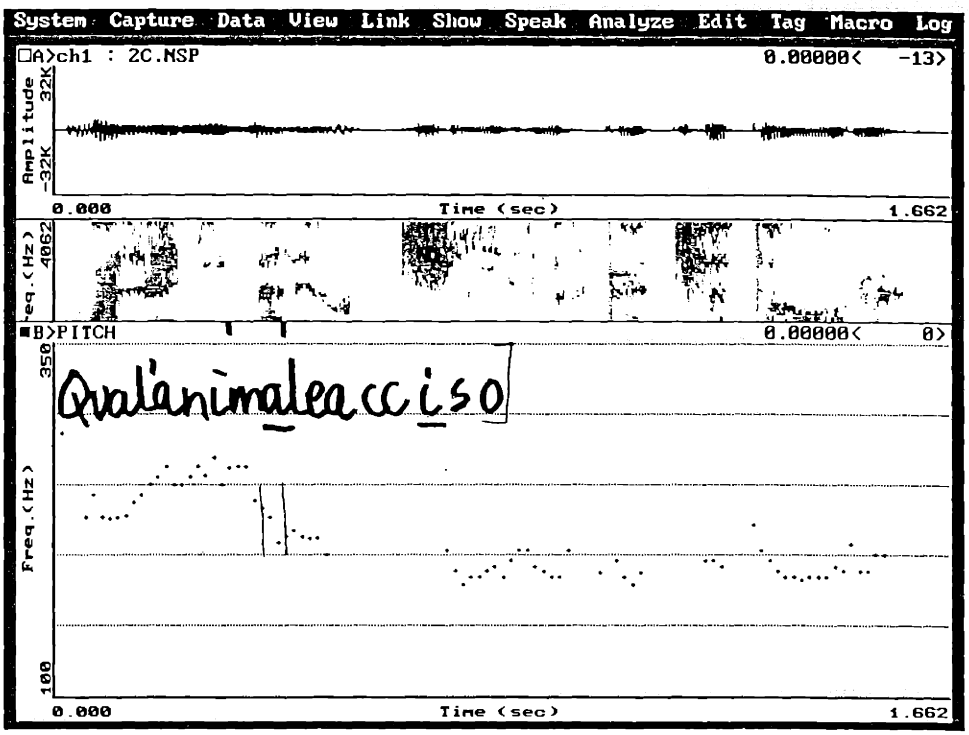



Figure for example (65) with interpretation b.
Quale ani**ma**le ha u**cci**so # il cacciatore?
LHH- (L*)L-L%

In the two utterances the F0 follows the same course during the wh-word *Quale*; the tone mapped onto this word is posited to be the familiar LH tone we have seen mapped onto Topics. The difference between the two pitch tracks lies in what follows the wh-word: in the utterance associated with interpretation (a.), where *quale animale* is taken to be the subject of the sentence, the accented syllable of *anim**a**le* is longer than the corresponding syllable in the utterance associated with interpretation (b.). There is good reason to believe that this is due to pre-boundary lengthening, so that in (a.), but not in (b.), there is an intermediate (or intonational) phrase boundary. The same is true for the accented syllable in *ucc**i**so*: the one in (a.) is shorter than the one in (b.). Across various repetitions the average length for a pre-boundary accented syllable ***ma*** is 0.203 msec and for a pre-boundary ***cci*** it is 0.271; while the average length for ***ma*** not in pre-boundary position is 0.127 and for it ***cci*** is 0.206. This cue alone could be enough for the hearer to disambiguate the utterance. The material following the word with lengthening is emarginated in the same way as the material following focused constituents.

There is another difference though between the two utterances, probably derivative of the one discussed above. The F0 seems to reach a L target earlier in (65a) than in (65b), that is, the F0 seems to reach a L target right at the point of pre-boundary lengthening. Whether these two phenomena are related or not, and , if yes, which one is derivative and which one is primitive is a question I will not discuss here.

## 6. Tones, tone structure and concluding remarks

We have individuated two types of tones, or pitch accents: L and LH. The L tone has been found in declaratives denoting broad focus and in yes/no questions, either denoting broad focus or narrow focus; it is always aligned with the accented syllable of the word carrying sentential stress. On the other hand, the LH tone is found mapped on topicalized constituents as well as aligned with the accented syllable of narrowly focused elements in declaratives, although its distribution could be more widespread (see below).

The L tone displays rigid alignment both when a monotonal pitch accent and when a leading tone for the bitonal LH. On the other hand, the alignment behaviour of the H tone of the bitonal LH depends on which phrase tone follows it. More precisely, while the L rigidly aligns with the left edge the H target can be found as far as in the middle of the post-accentual vowel. The LH tone is best conceived as a complex tone rather than a bitonal tone since we have seen that it does not meet requirements for either L*+H nor L+H*, if the star notation is to be taken seriously.

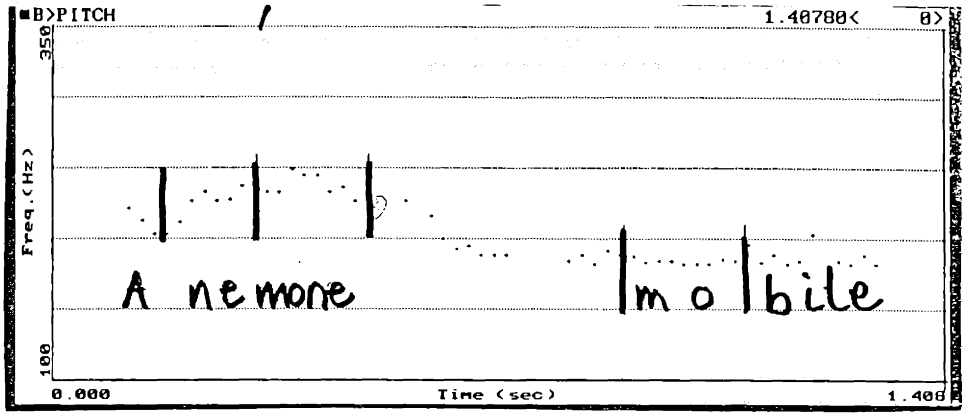
There is reason to believe, as has already been noted, that this LH tone is the same kind of tone found pre-nuclearly in Modern Greek. Arvaniti, Ladd and Mennen (1998) are faced with an F0 contour which has the same characteristics as the one found here: the F0 "seems to consist of a tonal sequence LH with the L and the H defining the beginning and ending points of the sharp rise". They discuss the difficulty of placing the tone in either of the relevant categories considered by Pierrehumbert, that is, L*+H or L+H*. They conclude by pointing to the inadequacy of the current system in dealing with leading and

trailing tones. In addition, they call for a better notion of phonological association and for a better definition of phonetic alignment, observing that phonetic alignment cannot be used as the defining characteristic of starred tones.

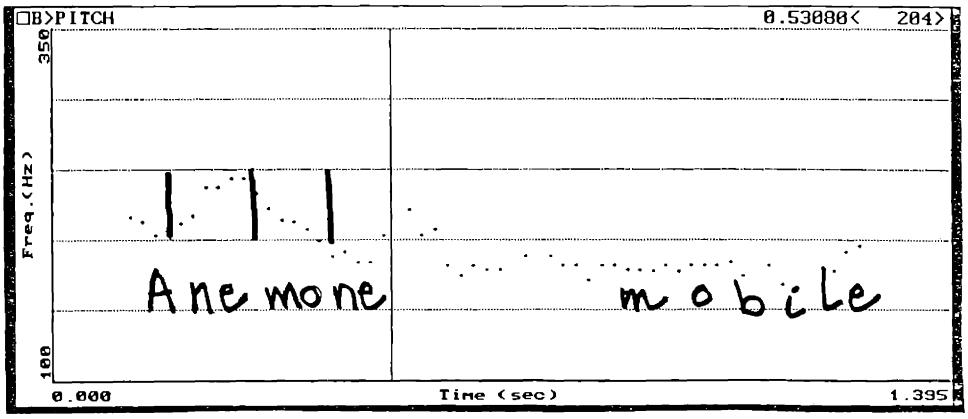
We have seen how the LH tone is mapped both onto Topics and Foci; one might then wonder why the F0 tracks mapped onto these two categories are different. I have proposed that the different F0s, and in particular the different alignment behaviour for the H, are a result of the phrase tones that follow the two LHs: H- for Topics and L- for Foci, in declaratives. In the case of the LH mapped onto focused elements, because of the following low phrase tone, the H of the LH tone aligns early, that is, within the accented syllable window, if the accented syllable is close to the end of the word, otherwise it shifts towards the right edge, or past it, as the accent moves farther away from the end of the word. This phenomenon has been observed by Silverman and Pierrehumbert (1990) for prenuclear H* in English, by Prieto, van Santen and Hirschberg (1995) for H* in Spanish and by Arvaniti, Ladd, and Mennen, (1998) for Greek LH: these studies all show that the peak of a non-final accent occurs proportionally earlier the closer it is to the accented word.

That the difference between the F0 found for Topics and the one found for Foci is a result of the different phrase tones is clearly seen in the yes/no question data. Figures (66)-(69) are all instances of the string *Anemone compra un mobile* with different tonal sequences mapped onto it:

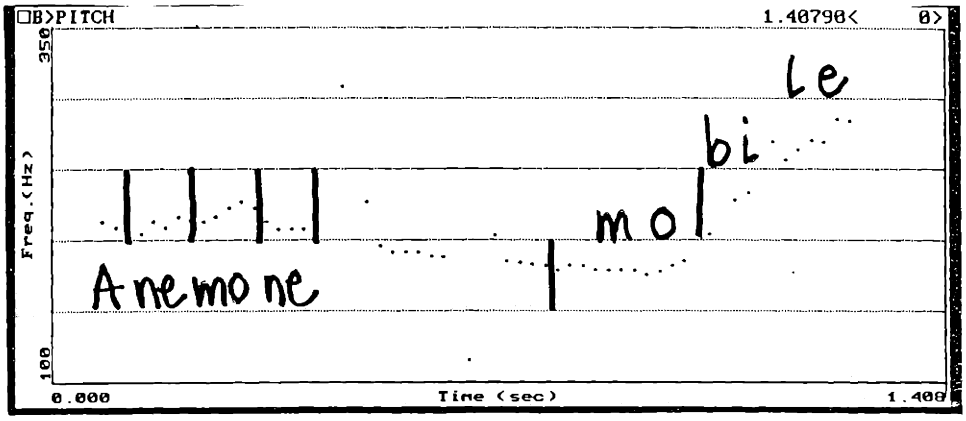
(66) **An**emone compra un **mo**bile.
LH H- L L- L%



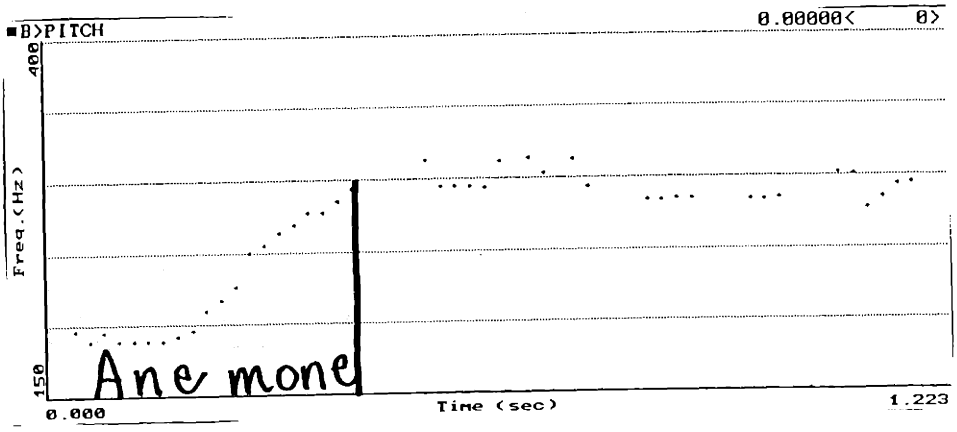

(67) <u>An</u>emone compra un **mo**bile.
LH L- L% L L- L%



(68) Anemone compra un **mo**bile?
LH H- L H- H%



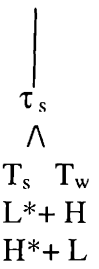

(69) <u>Ane</u>mone compra un **mo**bile?
LH L- L% L H- H%



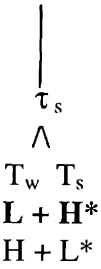
In example (66) and (68) we have two instances of *Anemone* functioning as Topic: the sequence LH H- is mapped onto it in both cases. There is a difference in how the the F0 is realized for the accented syllable ***ne*** in (66) vs (68) in that in (68) the value is not as high as in (66). This is probably due to the fact that since pitch has to eventually rise to a higher level in (68) towards the end of utterance the F0 at the beginning of the utterance is consequently compressed. Comparing (66) with (67) we see how in both cases the F0 value towards the end of the accented syllable ***ne*** is 250 Hz. Only after the end of the vowel do the two F0 tracks converge: in (66) the F0 value reached at the end of the vowel is maintained if not raised a little while in (67) the F0 clearly declines steadily until the end of the word. In the yes/no question in (69) *Anemone* is focused and as such it bears the LH tone; the phrase tone that follows is a H- and it is followed by a H% typical of yes/no questions (remember that the L- phrase tone following the LH mapped onto focused items only occurs with declaratives). The H- phrase tone following the LH is responsible for the rise from 200 Hz to 250 Hz in both (66) and (69), the presence of the H% boundary tone in (69) pulls the F0 for that utterance even higher, that is, at 300 Hz. In fact, the value of 300 Hz is reached in (68) too after the H-H% sequence proper of these yes/no question contours.

An internal structure similar to the one given by Grice for the Palermo Italian bitonal tones and discussed above would not account uniformly for the LH found here. Remember that her theory predicts that the starred tone in (70a.) should be aligned later in the syllable than the starred tone in (70b.). This is *not* the right PA structure for the LH tone though, since the H(*) has been found to align with the post-accentual syllable.

(70) a. PA




b. PA




We have found the need to assign a tone to an F0 movement before the accented syllable, as is the case of the L in the LH tone. In principle this is support for a framework more similar to Pierrehumbert's one that to Ladd's; remember that Ladd does not deem prenuclear material relevant for pitch accent asignment/association. Ladd's tone inventory is L, H, LH and HL, but the L and H initial tones in the bitonal sequences are not leading in any way, these tones are the ones aligned with the accented syllable. So, there seems to be a deficiency in Ladd's system, as described in his *Intonational Phonology* (1996), as far as F0 movements before the accented syllable are concerned. A second deficiency is that only one type of edge tone (T%) is used in Ladd's system, while we have seen that there might be evidence for two such tones, T- and T%.

Pierrehumbert's system does not completely suffice in describing the data either. The importance of leading tones is acknowledged but there is no way of accurately capturing the alignment of the LH complex tone. In conclusion though, Pierrehumbert's system seems to be adequate enough in that the tone in question could be analyzed as a L+H* tone if her theory were coupled with a theory of alignment which could explain why in certain contexts starred tones do not rigidly align with accented syllables. The

inadequacy of the two models may indeed stem from the necessity to refine phonological association and phonetic alignment and the relation between the two, as Arvaniti *et al.* suggest.

One surprising conclusion is the fact that only two kinds of pitch accents have been found, L and LH. One would expect a broader range given that the number of pitch accents found in English is much higher. This could be because the utterances in the corpus are short and therefore there is less probability for "rarer" tone sequences to occur. Another reason could be that the speech in this corpus might suffer from being too controlled in the sense that more natural speech might have displayed more dynamicity with respect to intonation and therefore other types of tones could have surfaced.

The exclusion of data from speakers of a Standard Italian variety different from mine was deliberate but it would be worthwhile to collect similar data from these other speakers and compare the resulting tonal sequences with the ones proposed here. In particular, it is hypothesized that if a LH (prenuclear) tone is found mapped onto Topics in these other variants of Standard Italian as well, then it will display the same behaviour with respect to its alignment properties.

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